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EGG FARMING

A Practical Reliable Manual Upon Producing Eggs and Poultry for Market as a Profitable Business Enterprise

BY

WILLARD C. THOMPSON, Ph. D.

Professor of Poultry Husbandry, Rutgers University, the State University of New Jersey.

ILLUSTRATED

Revised Edition

CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE, * MYSORE *
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NEW YORK
ORANGE JUDD PUBLISHING COMPANY, Inc.
1950

2529

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Reprinted with corrections April, 1942
Reprinted September, 1943
Reprinted January, 1945
Reprinted February, 1946
Reprinted April, 1947
Reprinted July, 1950

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DEDICATED TO

the memory of my father,

GEORGE E. THOMPSON,

under whose wise and kindly counsel the early years of my life were spent on the home farm in Wisconsin, and whose genial and wholesome philosophy of life has ever remained as an inspiration and real support —farmer, and great believer in Agriculture as the keystone of the American nation

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FOREWORD

During the last forty years the author has been attempting to serve the poultry industry through the channels of education and research. His experiences have been varied and scattered through many phases of this great industry. He has been privileged to see poultry keeping, and in particular table egg farming, in many parts of the United States, Canada, and England. In those years he has formulated a sort of philosophy concerning egg farming as a business enterprise. In these pages he has attempted to set down some of those thoughts, for what they may be worth to anyone, student or practical poultry farm operator, who is really interested in a workable plan for the conducting of the business of commercial table egg production. He has not intended to present a reference volume. He does make his most sincere and profound acknowledgements to all poultry writers and to all poultrymen whose works have been an influence in the formulation of the subject matter laid down in this book.

The attempt has been to discuss egg farming as a means of earning an honest livelihood, and to approach it from a most utilitarian viewpoint. Many may differ on this point and that. Whatever has been included in these pages is the conviction of the author and is sent forth in the hope that it may be a useful guide to many.

The author was deeply indebted to the late Dr. J. G. Lipman, Dean and Director of the New Jersey Agricultural Experiment Stations, under whose direction he served for more than twenty years, for gracious permission to use pictures which have from time to time been used in illustration of certain New Jersey circulars and bulletins, and for permission to quote from those publications which have been a part of the author's official offerings through the years. Also is grateful appreciation extended to the editors of the Rural New-Yorker, Everybodys Poultry Magazine, the American Poultry Journal, and many other papers in which some of the pictures herein used have appeared in times past in illustration of articles contributed by this author. And to the several friends, including Strohlein Brothers, Messrs. Lyle and Beall, and others, who have permitted the use of certain photographs. To Mr. George H. Pound, Commercial Photographer, and one-time associate in poultry department work, is great indebtedness paid for the excellence of the photography furnished. To Dr. Charles Crowther and his associates of the Harper Adams Agricultural College, and the National Institute of Poultry Husbandry, Newport, Salop, England, does the author express heart-felt thanks for two happy, gainful years spent in close association with the British Poultry Industry.

In particular, does the author record his indebtedness to his wife for long hours of helpfulness and assistance in the preparation of this manuscript.

This book has been written because of the repeated requests from friends in the industry of poultry and egg farming for the author to gather together the ideas which he has formed during the years since 1912, years in which great changes have been taking place in poultry keeping. New Jersey, situated so near to the great metropolitan and consuming center of New York City, has rather naturally developed an intensive type of egg and poultry production. The author has been privileged to work in the heart of this area. If he has caught something of the philosophy and practices which have motivated men and women in that section of the industry and have led them to establish an enviable place in the country's poultry business for themselves, he trusts that he has been able to write them into these pages. These discussions, for such are the types of presentations to be found herein, have been couched in conversational style. Those who want to explore the possibilities of poultry and egg farming approach the matter in a most practical, matter-of-fact way. They go, in proper time, to the books of science for details, the stories of discoveries, and for proofs. But, when facing the business phases of poultry and egg production, they must find some practicable method which has worked and which will work again, and follow it through. Here is set forth some points which the author believes have worked out satisfactorily and economically in practice and which will work out that way again.

This revision is made in a year when America's participation in World War II thrusts upon her poultry raisers a great responsibility. Poultry meat and table eggs, indispensable foods of highly health-protective character, are being recognized as "foods needed for the national defense." More than ever is a brief, concise outline of a modern system of poultry and egg farming placed in a position of being able to render an unique service to country and mankind.

—WILLARD C. THOMPSON.

New Brunswick, New Jersey.

FOREWORD TO 1950 REVISED EDITION

Good egg farming principles change little with the passage of years. Good egg farming practices do change, from time to time, as research and experience find new and more efficient ways of doing things. In revising this book at this time it has been found that relatively few changes have to be made. Rations, in particular, have undergone changes, and these have been indicated in proper places in the text. Now, in 1950, as in the year in which EGG FARMING was first written, the business enterprise of food egg production flourishes in the United States of America. America's population continues to increase. People eat more eggs than ever before in history. The economic need for the products of this branch of farming steadily increases. It is hoped that these pages will continue to help to make the industry a safe and satisfying kind of farming.

—Willard C. Thompson.

New Brunswick, N. J., April, 1950.

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Egg Farming

I

THE MODERN INDUSTRY OF EGG FARMING IN THE UNITED STATES OF AMERICA

THE daily menu in practically every American home in these modern times contains articles of food in the preparation of which eggs form an important part. That same menu usually includes eggs as such, that is boiled, fried, scrambled, or in some other attractive form. The American housewife has longsince recognized eggs as health-protective foods. Their place in the diet has firmly been established. To supply the many millions of eggs which are required daily by the American public becomes a large and economically significant enterprise. The business, then, which has as its chief objective the production of eggs is a business indispensable to the welfare of the country and its people. Since egg farming is that portion of the modern poultry industry which is comprised of the business of producing eggs for table purposes it is to be looked upon as a food-producing industry. This point of view intimates at once that egg farming has been developed to meet a need and that it may reasonably anticipate a fairly safe and stable future. It suggests that egg farming is based upon a product for which there will continue to be a constant and continuous demand. It is always important for anyone exploring the economic possibilities of any sort of business undertaking to ascertain, in so far as may be feasible, the degree of permanence which attaches to that type of industry. The prospective egg farmer may find some assurance as he investigates egg farming. There is promise of a future there.

Several Types of Egg Farming Exist.—An interesting feature of present-day egg farming consists of the many types of table egg production which are included within it, and the fact that profitable egg yields can be secured under widely varying and differing ways and means. Such existence of a multiplicity of workable methods opens the industry to a much wider group of people than would otherwise be the case. The principal types of egg farms supplying the nation's daily needs are:

1. *Commercial Egg Farms.*—Such farms may be defined as farms on which primary attention is given to the producing of table eggs, or farms on which table eggs are the major, if not the entire, product. Modern commercial egg farms have become highly specialized types of farming, concentrating efforts, capital, labor, and endeavor upon the economical and efficient production of table eggs. These farms have been a natural development, following the

splitting up of the large farms of a few years ago and the general acceptance of intensive methods. Size, or acreage, is not a criterion of measurement. In many sections of the country, such, for example, as in New Jersey, certain parts of the New England States, parts of California, and others, specialized egg farming has come to be a well-established and definitely recognized branch of agriculture. The tendency of commercial egg farms is to specialize in the production of table eggs which may be merchandized under the label of "fresh eggs." There are several ways and means of building up commercial egg farms, as will be shown later in this book, and they will lead to many different forms of enterprise —yet each will be a commercial egg farm.

2. *General Farm Flocks.*—The greater percentage of the nation's present egg supply comes from the great aggregate of farm poultry flocks, from farms whereon the poultry flock is a minor rather than a major enterprise. That there is a decided trend toward placing the farm poultry flock upon a sounder economic basis than it has previously possessed and toward making that flock, especially in its capacities as an egg producing unit, a more efficient part of the farm is obvious. The methods and practices of the modern egg farmer are open to the general farmers of the country and will be increasingly employed in the days to come. There is no reason why table eggs of the highest possible quality should not be produced by the average farm poultry flock, and, consequently, there is no reason why the aver-

age farmer should not share the profits which may lie in the business of table egg production.

3. *Suburban Poultry Flocks.*—The backyard poultry flocks, or suburban flocks, of this country have long been important sources of fresh table eggs for city dwellers. They will continue to be. With changes in economic conditions generally within the country the possibilities of maintaining and managing egg-producing flocks as a supplementary source of income, or as a part-subsistence proposition may command an increasing amount of attention. Again, no radically different methods and practices are required. City and suburban people may, in

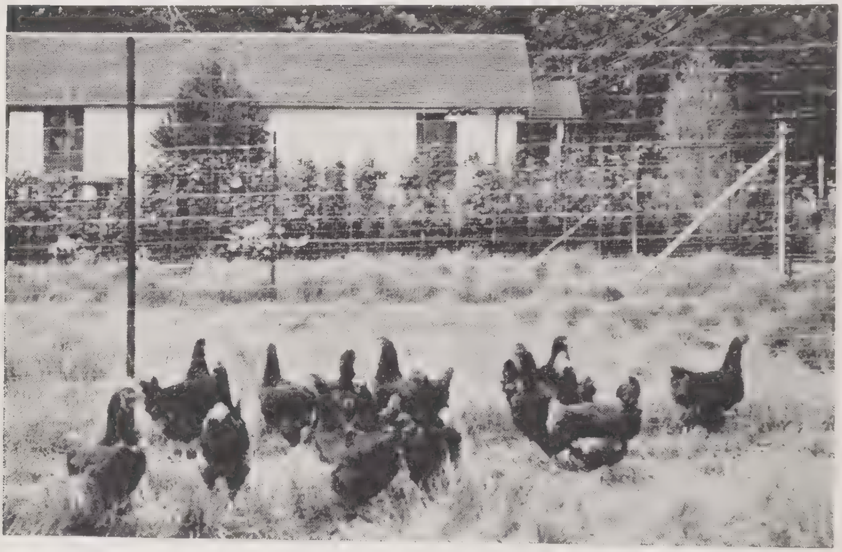

Fig. 1.—The Rhode Island Red, a pure breed of American origin, has become a national favorite with American general farmers because of its capacities along both egg and meat production lines.

increasing numbers, become members of the industry of egg farming.

4. *Intensive Egg Factories.*—A very recent development, that of managing laying fowls in individual cages, gives rise to a type of egg farming which may well be called an "egg factory." It permits of development in locations and on sites which have not heretofore been considered possible places for egg farming. That such a type of intensive egg production will find its place in the modern egg farming industry is undoubted.

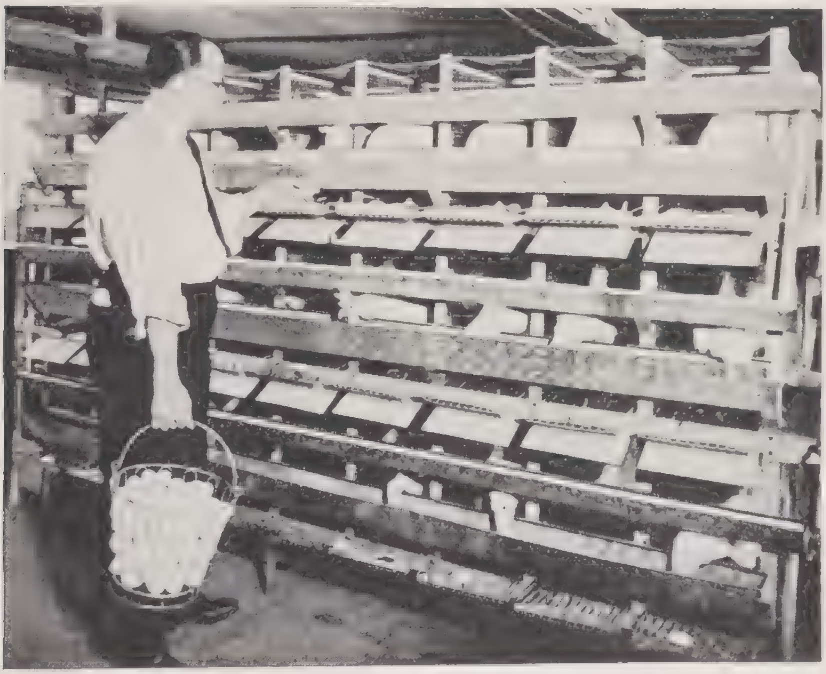

Fig. 2.—The management of layers in individual cages serves as an illustration of the intensive adaptation of mechanical devices to the practical handling of hens for egg yields—egg factories.

Wherever people will be found each of the above types of egg farm development will be found in varied forms and in varying proportions. Experience has demonstrated that there is no one best way or method of building up an egg farm within any of these types. That such plants may be built in a great variety of ways and all be found possible of successful operation enlarges the scope of the industry and offers its business opportunities to a much wider group of people.

Egg Yield Basic to All Types of Poultry Farming.—There are many phases of modern poultry culture which are not primarily engaged in table egg production, such as the day-old chick industry, the production of exhibition, Standard-bred stock, the business of producing pedigreed, trapnested breeding stock, and similar enterprises. Basically, however, the success of each of these branches of poultry keeping lies in the degree to which the poultry stock used can render an economical accounting as profitable egg producers. Pullet flocks, in whatever type of poultry plant may be set up, are primarily managed for table egg production. To secure efficient table egg yield is basic to the success of every poultry raising endeavor. All poultrymen are, to some extent, egg farmers, and all should employ fundamentally similar principles and practices.

Profits from Egg Farming Depend upon Four Factors.—There are certain controlling factors which determine the business success with which any venture into egg farming may meet. The egg farmer must treat egg production as a business proposition. He must try to ascertain in the beginning just what are the factors which will arise as determinants of the economic success of his undertaking. Business success in egg farming must probably be defined in terms of profits. It is a business failure, if no profits are realized, and if the money invested in it is lost.

An analysis of many modern egg farm ventures suggests that there are four principal factors involved in successful egg production:

1. *The Hen—The Production Unit.*—The marketable table egg is the unit commodity in which the egg farmer is primarily interested. To get a sufficient supply of saleable eggs economically from the given flocks is the main objective of the egg farmer. The basic importance of the bird which produces those eggs, therefore, is obvious. The profit-yielding flock must be constituted of good layers. Each hen must be capable of adding to the total output of the flock an economical portion of the total eggs produced. In measure as each hen does do that is she an economical and profitable unit of production. Any flock of layers is a profitable business investment in extent as the individual hens in such flock add economical yields to the flock total. It is just common sense to infer, then, that every flock is as satisfactory as a business as are the respective hens which comprise it. Each uneconomical egg producer in the flock tends to lower the money-making

possibilities of the flock as a whole. Each non-layer, each cull, each low producer becomes a money-losing factor in the business. Each hen which passes out of the flock as a mortality case during the year lowers the business potentialities of that flock. Too great emphasis cannot be laid upon the fundamental importance of "quality poultry stock" as a first essential to profitable egg farming in these times.

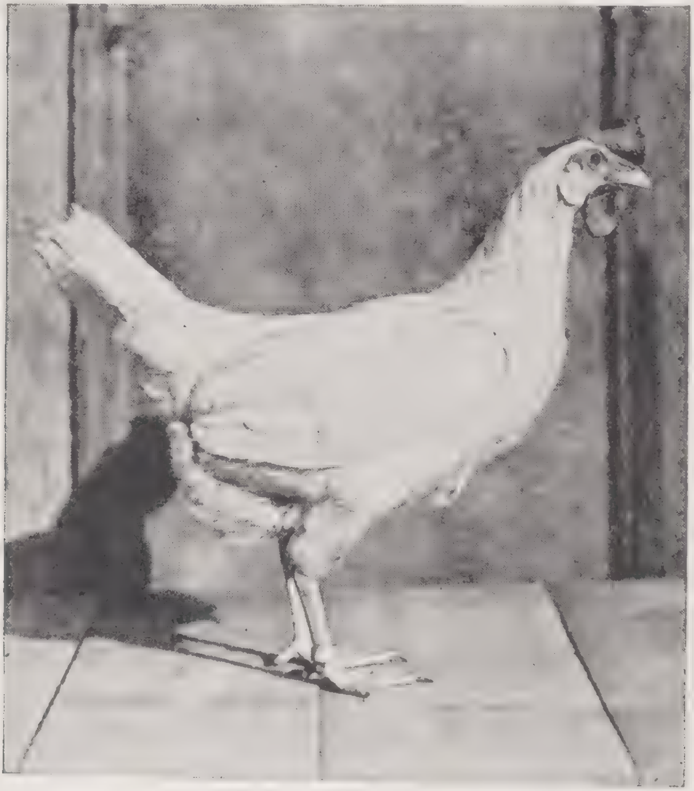

Fig. 3.—A 300-egger, hen No. 4617, laid 300 eggs during her first year, of which 78 were produced during the winter season, 112 during the Spring, and 110 during the last four months, the Summer-Fall.

The hens, as egg production units, vary widely in their capacities to give profitable egg yields. The egg farmer must know and appreciate that fact. He must plan accordingly. Hens produce eggs in response to two sets of controlling forces, (a) those of inheritance, and (b) those of environment. The egg farmer must everlastingly seek to determine the ways and means by which he may mold and control both of these sets of forces so as to secure better birds, that is better production units.

The hens, again, as production units, must be bred and maintained toward the end of insuring profitable flock yields. It will be found that the efficiency of this egg production unit is a matter of:

a. *The Breed, or Variety Used.*—The egg farmer should select that type, breed, or variety of fowl which naturally tends to be an economical egg producer. The second chapter of this book will deal with this important phase of the problem. Here it is pointed out that much sound economy will be employed from the beginning, if a type of fowl is chosen for commercial egg farming which is, by nature and development, the sort of bird which is capable of most efficient egg production. It is a wasteful practice to attempt to adapt heavy, meat-type fowls to the needs of the egg farmer. Such types of fowls should be maintained as meat-producing birds, and their natural egg-yielding tendencies respected. The matter of type, breed, and variety selection is one of serious economic significance.

b. *The Program of Breeding and Flock Improve-*

ment Employed.—Within any chosen breed or variety it is always necessary to use some scheme of flock improvement through selection of breeding stock. With the years more useful information has come to hand as to those characteristics which are associated with heavy egg laying tendencies. Successful laying flocks can be built up only through the use of a carefully chosen breeding improvement program. Like tends to beget like. Other things being equal, the production of economical layers through inheritance is a thing to be sought. Before any system of environment or management is to be set up on an egg farm, it is urgently necessary that the poultryman shall have secured sound, inherently efficient stock. To continue in successful egg production under any system of management requires continuous attention to the maintenance of quality stock and to its gradual improvement in inherent capacities.

c. *The Maintenance of Health.*—Profitable egg production results only if the hens, as production units, are maintained in normal, natural health and vigor, and if disease, in any of its forms, is kept away from the flock or held to a minimum as an effective agency of destruction of normal activities. The methods and practices of the egg farmer must include those which look toward producing normal, healthy specimens of fowls, and then tend to preserve such condition. This health factor has much to do with regard to keeping the production units in continuous, active service in the egg-producing flocks. The point of view advanced here is one of constructive management. The aim of the egg farmer must be to secure healthy hens and to keep them in health throughout the season of egg yield. In measure as the egg farmer is able to get good hens, of the right type, and of good lineage and breeding, and is able to keep them all living and laying does he stand a good chance of winning success in table egg production.

Fig. 4.—This typical breeding flock of White Leghorns, taken on a New Jersey egg farm, exemplifies that system of breeding improvement program which is essential to the maintenance of flock efficiency year after year.

2. *The Food—The Raw Materials.*—Table egg production is simply a process of turning certain raw materials, the various food stuffs fed to poultry, into a product which is of value to the human

family as one of its principal foods. It is, in a way, a manufacturing enterprise. It is an industry in which needed and useful products are made out of other materials. The hen, in such a conception of the business of egg farming, is the machine into which the raw material is placed for transformation into the end product desired, table eggs. It matters little that the machine is a living organism rather than a structure of wood or metal. From the business standpoint the situation is one of handling a device which turns out a saleable product. The nature and cost of the raw materials furnished into the machine has much to do with the nature and cost of the end product. In order to help insure the production of eggs at a minimum of cost it is not only necessary to furnish efficient machines, that is hens, but it is equally necessary to furnish raw materials, that is foodstuffs for the hens, which are (a) economical in actual cost at time of use, and (b) efficient for the purpose for which they are fed. The output per given unit of raw materials used must be as large as possible. In other words, the egg farmer must constantly attempt to keep the cost of raw materials down to a minimum while not in the least lowering the efficiency or effect of the feeding.

Foodstuffs, as raw materials, enter the picture of modern egg production, as controlling factors in three ways:

a. Fowls require certain food nutrients in order that they may function normally and healthfully and turn out the work expected of them. Egg farmers must become familiar with the nutrient requirements of the hens which he is using in his business. He must know what sort of raw materials must be furnished in order to accomplish the ends he has in mind. He must be familiar with the food nutrients contained in the available foodstuffs, the raw materials he is to use in his business of egg production. In the present day he must include in his information concerning foodstuffs and concerning his fowls not only data about proteins, carbohydrates, fats, and minerals, but vitamins as well, and perhaps, even other things.

b. The egg farmer must furnish the essential ingredients of the daily diets of his hens in certain balance. Rations must be concocted. Combinations of foodstuffs which will accomplish the desired purpose must be arrived at. The final costs of all such mixtures must be reckoned with. In measure as any ration furnishes the required nutrients efficiently and economically it may be considered a good business asset. Conditions of cost and available supply of foodstuffs are frequently changing. The egg farmer must be familiar with fundamental principles involved in order that he may meet varying and changing conditions on the feed markets.

c. There are many satisfactory ways and means of feeding hens. There are many wasteful, unsatisfactory, inefficient ways of feeding hens as well. The successful poultry feeder, therefore, must be capable of furnishing properly selected foods or rations to his hens in such form and manner as will result in their taking in sufficient quantities of those rations as will stimulate increased and economical egg yields.

3. *The Environment—The Stimulant to Activity.* —Fowls may be inherently capable of heavy and rapid egg yield but never actually produce it because of the inhibiting effect of adverse or unfavorable environmental conditions. Surrounding conditions must have the effect of satisfying the hens, of making them contented and happy, of stimulating them to a normal and natural use of the foods fed to them, and of preserving inherent strength, vigor, and health. When surrounding conditions work against any of these things egg yields are decreased. Environment is a controlling factor. It probably does little in itself actually to promote higher egg yields, but it constantly provides a set-up of conditions under which normal functioning as to egg production does or does not take place, depending upon the favorable or unfavorable character of that environment. The egg farmer must seek to find that type of environmental set-up which will stimulate or incite optimum egg production.

The environment of fowls on the modern egg farm is a matter of:

a. The poultry buildings in which the egg producing hens are kept. There are many satisfactory types of houses which may be used on the modern egg farm. The egg farmer must be familiar with at least one workable, efficient type of building which he can use. He must know (1) economical plans for and methods of constructing the needed buildings, (2) efficient and practical ways of using the buildings at hand in order to make an optimum use of monies invested in such buildings and equipment, and (3) the effects and influences of methods of building management on the health and productive tendencies of the birds.

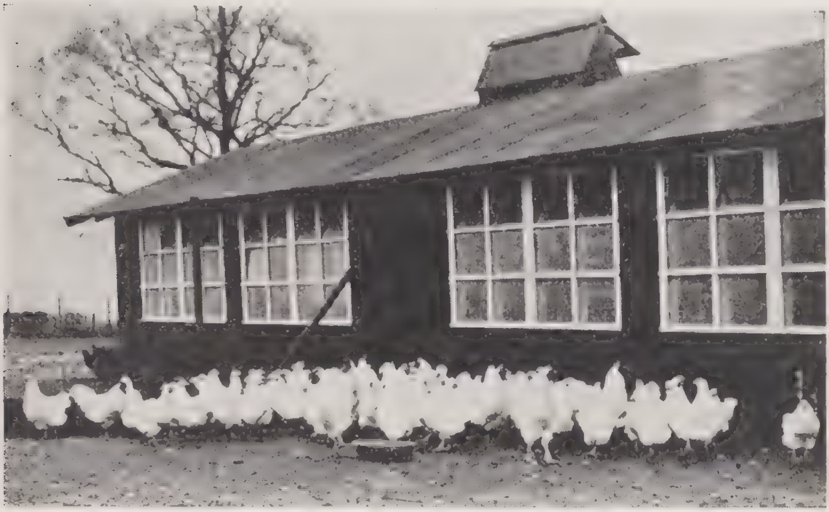

Fig. 5.—This 20′ x 40′ modern poultry laying house at the National Institute of Poultry Husbandry Research Farm, England (designed and built by this author in 1925), furnishes an example of an environment which stimulates egg production from the flock living in it. The hens in this flock were White Wyandottes of a well-known English strain of prolific layers.

b. The soil with which the layers come into contact at one time or another during the year. Some types of egg farms employ the extensive, or semi-extensive, methods which include the use of large yards, ranges, or field, over which the hens are allowed to roam for at least some portion of the year. In some instances the actual contact with the soil may be limited to the growing or rearing season, while in others it may be continued more or less throughout the useful life of the fowl. In any system which does use any part of the land or soil directly for fowls that soil or land becomes an influencing part of the environment, and must receive consideration.

4. *The Human Element—The Business Management Factor.*—Under this factor must be included all those things which the man in the given situation has to do in order that the hen, the producing unit, may be enabled to use the food, the raw materials, and respond to the stimulating influence of a favorable environment. It is the poultryman's job to make the combination of these factors such as will result in a margin of profit in the enterprise. It involves the use of capital, the management of investment, the operation of equipment, and the handling of all angles of the business in such manner as will hold costs to a minimum and secure sales at rates which are fair and equitable to all concerned.

Any useful exposition of ways and means of setting up a modern egg farm must be built upon the basis of these four points.

Limiting Factors to Egg Farm Profits.—It would be unbusinesslike for anyone to venture into egg farming without having made inquiry as to the nature and extent of any limiting factors which may obtain in that particular line of production. It would be a most unusual type of business, if there were not limiting factors to be met with. It is sound business sense to know as definitely as may be possible the nature and character of the obstacles which will probably stand in the way of unlimited profits. One is never in a position to overcome obstacles unless he has first seen and recognized them. Egg farming is no exception to the general rule. The limiting factors to profits in egg farming may be included within four groups, which, briefly stated, are:

1. There is a physical limitation in the average hen as to the number of eggs which the egg farmer may reasonably expect from her in the course of the year. One hen, that is one production unit, may be counted upon for a certain gross egg yield, but that gross yield is limited. As one investigates the average flock of egg producing hens on the average egg farm he is impressed with this fact. It is a situation which does set up a certain material limitation to the number of saleable table eggs which the egg farmer may reasonably count upon from a given flock of hens. In this regard it is necessary to know, in so far as the information is available, (a) something as to the approximate number of eggs which one may reasonably expect to get from average well-bred, well-reared, well-selected, and well-managed laying stock, under average conditions, and (b) something as to the possible ways and means through which egg yields might be increased.

From the study of actual flock egg yield records on typical New Jersey commercial egg farms over a ten-year period (1920-1930) and including over 5,000 layers, the figures presented in Table 1 have been evolved. They present the average egg yields which may be reasonably expected from pullet, or first-year, and from yearling layers, for each month, on a per-bird basis. Data have been studied on flocks managed under artificial illumination and without it. Early, medium, and late hatched flocks have been separately studied. This table may be found useful in several ways. (a) It may serve as a standard of egg yield, with which any given individual bird's egg yield may be compared at any time in an effort to ascertain how such record compares with what the average bird is known to have shown. It may indicate to the egg farmer whether his birds are doing just about what he may reasonably expect of them, or better, or worse. At once the use of such a standard becomes a gauge of the progress of the business of egg production. It may point out weak spots in management, or, on the other hand, it may indicate the more successful phases of the management. (b) It may serve as a reminder of the average man's experience and of the fact that the egg farmer, on the average, may not reasonably expect to accomplish appreciably more than has the average egg farmer of the past. It becomes a basis for farm-planning for the future seasons. It keeps one's feet down on the earth and counteracts a tendency to over-estimate probable returns. The figures in this table are offered, not

Table 1

EGG PRODUCTION STANDARDS

Month	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*usually*
1st	12	12							Aug.
2nd	12	15							Sept.
3rd	12	15	9	10					Oct.
4th	6	14	12	16	8	10	2	2	Nov.
5th	3	10	13	18	10	16	2	2	Dec.
6th	14	10	14	16	10	18	5	7	Jan.
7th	16	12	14	16	12	14	10	13	Feb.
8th	22	22	20	22	19	20	15	17	Mar.
9th	23	22	22	20	21	20	16	16	Apr.
10th	20	20	20	18	20	18	18	15	May
11th	11	11	16	15	18	16	15	15	June
12th	9	9	12	10	16	15	15	14	July
13th			7	7	13	12	14	14	Aug.
14th			5	4	7	7	10	9	Sep.
15th					6	6	8	6	Oct.
	160	172	164	172	160	172	130	130	Year

Note:—It will be obvious that the succeeding figures in each column will be respectively for each of the succeeding twelve months.

In the above table the capital letters stand for the following:

A. Early hatched pullets ready to lay about August 1st. No artificial lights used in their management at any time.
B. Early hatched pullets, but managed under lights during fall and winter seasons.
C. March and early April hatched pullets ready to lay about October 1st, but managed with no artificial lights.
D. Same medium hatched pullets, but managed under late fall and winter season artificial illumination.
E. Late April and May hatched pullets ready to lay about November 1st, but with no artificial lights used during the winter.
F. Same late hatched pullets, but managed under winter lights.
G. Yearling hens molting in fall and starting to lay approximately by November 1st, starting second year, managed without use of artificial lights.
H. Yearling hens managed under lights.

as an inflexible, unchanging standard, but merely as a guide. The figures should change as future experience does bring about changes in egg yield behaviors.

In the above table "average egg yield per bird" has been given for each month in the year, not on a calendar month basis, but rather upon each month in its relation to the time of starting egg production. For example, one is to read from this table the "average egg yield per bird" which may reasonably be expected during the third month of the laying year, or during the tenth month, etc., rather than for October, or June, or some other calendar month. Also, in the above table, each figure for each month represents the number of eggs which the average layer, continuing in good health, and surrounded by a safe and stimulating environment, under good management may be expected reasonably to produce.

When flocks of the various well-known and popular breeds of poultry have been bred and managed primarily for egg yield there is not great difference to be found between the various breeds' records as to amount and distribution of that egg yield. For all practical purposes, therefore, the figures in Table 1 may be used as bases for estimating of egg yields and for flock comparisons in the cases of any of the usual breeds and varieties ordinarily used on the egg farms of this country.

This author, in N. J. Agr. Exp. Station Bulletin No. 596, published in September, 1935, has pointed out that the egg farmer may be somewhat misled, however, if he holds the individuals in his flocks all up to the same egg yield standard. None of the strains of our modern breeds and varieties now used in egg farming have been perfected as yet to that point when all individuals tend to show even approximately the same, even, uniform rate and distri-

TABLE 2

DISTRIBUTION OF THE 908 S.C. RHODE ISLAND RED PULLET FIRST-YEAR EGG YIELDS FOR THE THREE PRODUCTION SEASONS

(Winter, Spring, and Summer-Fall) and for the Entire First Laying Year

	Part 1 Seasons						*Part 2 Year*		
	Winter		*Spring*		*Summer-Fall*		*Pullet Year*		
Number Eggs Laid	*No. Hens*	%	*No. Hens*	%	*No. Hens*	%	*No. Eggs*	*No. Hens*	%
120—	13	1.4	9	1.0	0	0	300—	40	1.1
110—	46	5.1	77	8.5	8	.8	275—	65	7.2
100—	115	12.7	167	18.4	23	2.5	250—	136	14.9
90—	135	14.8	192	21.3	60	6.6	225—	187	20.6
80—	128	14.1	168	18.5	118	13.0	200—	166	18.3
70—	107	11.8	103	11.3	131	14.4	175—	116	12.8
60—	119	13.1	73	8.0	135	14.9	150—	91	10.1
50—	79	8.7	42	4.6	137	15.1	125—	47	5.2
40—	58	6.4	30	3.3	106	11.7	100—	18	2.0
30—	41	4.5	18	1.9	56	6.2	75—	16	1.8
20—	22	2.4	7	.8	55	6.1	50—	9	1.0
10—	28	3.1	15	1.6	48	5.3	25—	13	1.4
0—	17	1.9	7	.8	31	3.4	0—	3	.3
Total	908	100.0	908	100.0	908	100.0	Total	908	100.0
Mean	64.77		85.00		70.33			213.40	

Note:—Lowest line gives average or mean egg production for period.

bution of egg yield. It becomes necessary, therefore, for the egg farmer to have flock egg yield standards to use as well as standards for individual hens. From that bulletin, through the courtesy of the Station, Table 2 has been prepared, giving the distribution of various levels of egg yield for each season of the year. The data relates to flocks which included 908 S. C. Rhode Island Red pullets. The bulletin presented similar data for Barred Plymouth Rocks and S. C. White Leghorns, and showed striking parallelisms throughout.

The data in Table 2 are shown here to indicate to egg farmers that they must expect that the average flock of layers which they may be depending upon as profit-earners will vary widely as to their respective egg production performances. It is from such typical, widely varying flocks, however, that the "average egg yield per bird" presented in Table 1 has been derived. These two tables of data, taken, as they were, from the aggregate of many experiences, offer evidence on the point of the limiting factor of the physical capacity of the average layer to produce eggs over the course of an average year.

Boiled down to simple, practical statements this limiting factor means that (a) the egg farmer may reasonably expect his average layer to produce approximately 160 to 175 eggs during her first or pullet year and about 130 eggs during her yearling season, and, further, (b) that such average annual egg yields will be increased from year to year only very gradually. True enough, then, there does appear a limiting factor in that physical capacity of the average hen to produce eggs. It is useful to know and remember this fact.

This physical limitation of the average layer may be made somewhat less of a limiting factor to profits, however, through the employment of such management methods as

1. The adoption and operation of a well-organized poultry breeding improvement program, in which increased attention is given to the selection and use of breeding stock each year which has an ever-increasing egg yield tendency and capacity.

2. The use of all possible sanitary precautions toward the end of maintaining as nearly as may be possible 100% of health and normal, natural activity and productivity amongst the flocks.

3. The management of all flocks according to such approved methods and practices as give promise of securing a maximum, safe egg yield.

The physical limitations of the average layer should not discourage any egg farmer, but rather furnish him with facts upon which he may organize and plan his business undertaking with an increased sense of security.

2. There is a physical limitation to the number of hens which the average labor unit, that is the average egg farmer, can satisfactorily manage and care for in the course of usual working hours. There are certain duties which must be performed daily and others which require occasional attention. It takes time to do the ordinary work involved in

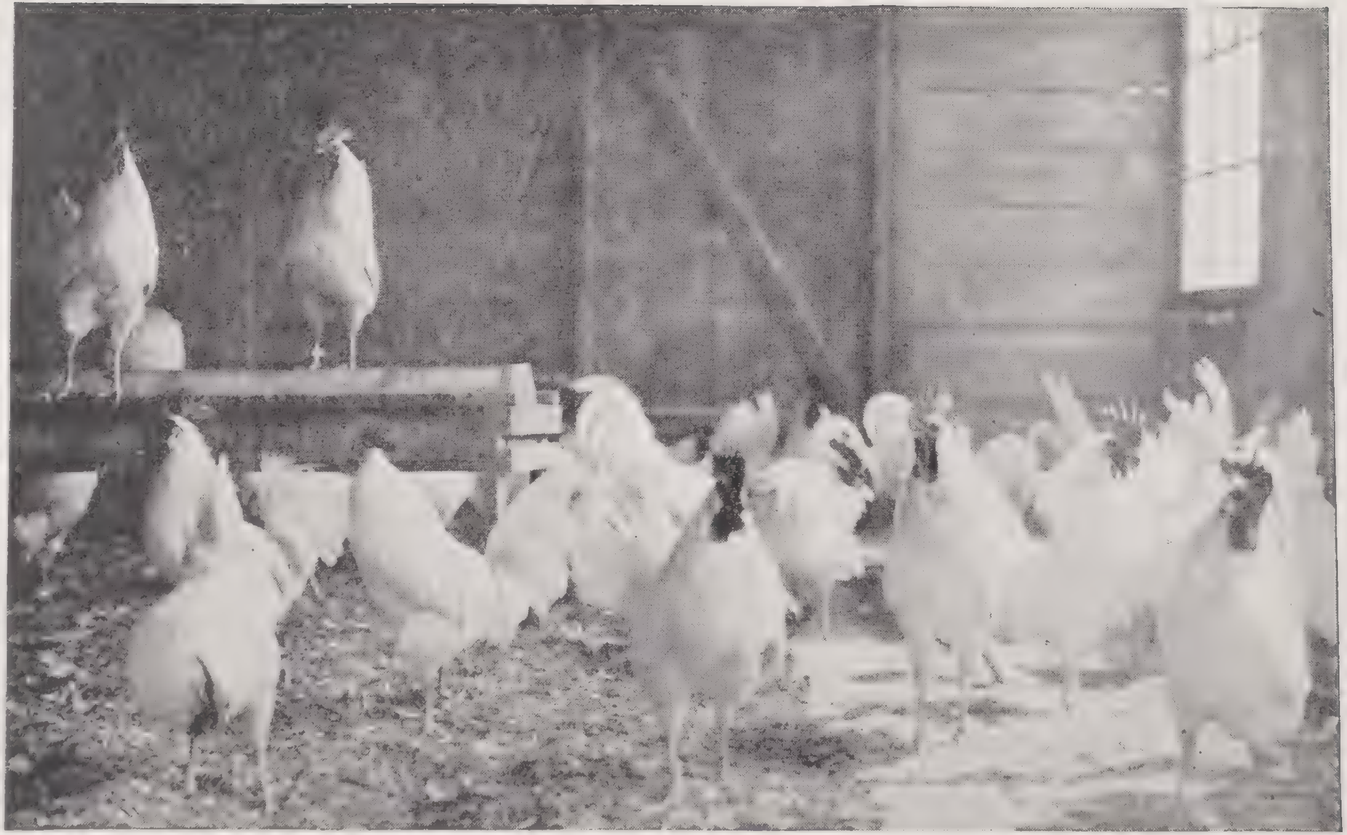

Fig. 6.—A flock of pedigree S. C. White Leghorn cockerels which have been carefully reared and which might well be used on any modern egg farm as one step in the process of building up the average egg yield per year per layer.

the operation of a modern egg farm. There are just so many hours in the working day or week. There is a definite limit to the number of layers which one person can take care of in available time. One must recognize this fact. This number, whatever it may be in the individual case, multiplied by the average number of eggs which may reasonably be expected from each layer gives an approximation as to the number of saleable eggs which one person may anticipate being able to produce with the given outlay of time and labor. To say just what the limit as to the number of layers one egg farmer can handle might be is difficult, because it depends upon so many, widely varying factors. Among these factors are (a) individual ability, (b) speed at which one works, (c) education and training along egg farming lines, (d) experience, (e) aptitude for such work, and liking for it, (f) conditions under which work has to be done, and other things. It is, of course, also to be borne in mind that financial considerations often set a distinct limit to the number of layers which the egg farmer may have at his disposal. Under average conditions and in usual situations, however, it is suggested that one egg farmer will probably find his limit as to the number of layers to be kept under his management somewhere between 1,000 and 2,500 birds. This suggests that the average one-man commercial egg farm, therefore, might be looked upon as being, probably, approximately a 1500 layer plant. There, appears, then, the limiting nature of this factor.

3. There is a limit to the price which the consuming public will be willing to pay for eggs. This limitation is reflected in the scale of egg prices which have been found to exist on the New York, Boston, Chicago, and other great egg markets of the country during recent years. The average user or consumer of eggs must bear the cost of those eggs in mind. Eggs represent only a part of the diet. Egg prices vary in different sections of the country. And yet there is a general level which for the purposes of estimating the business possibilities of an egg farming enterprise might be found as characteristic of the average price—from two to four cents per egg net, perhaps.

While the data presented graphically in Figure 7 represent the periodic fluctuations in one grade of table eggs only, and on only one market, the egg price levels, as well as the seasonal differences in prices, do give evidence concerning the limiting character of market egg prices in the determination of the potential earning capacities of table egg producing flocks. Even though every possible attention may be given in every egg farm situation to the finding and using of the best egg market available, the limitation set by the probable and usual prices received for eggs remains. It is a fact to be reckoned with.

4. There is a fourth limiting factor to egg farm profits which is to be found in the fact that, under average conditions on average poultry plants, not all of the individual fowls which are reared through

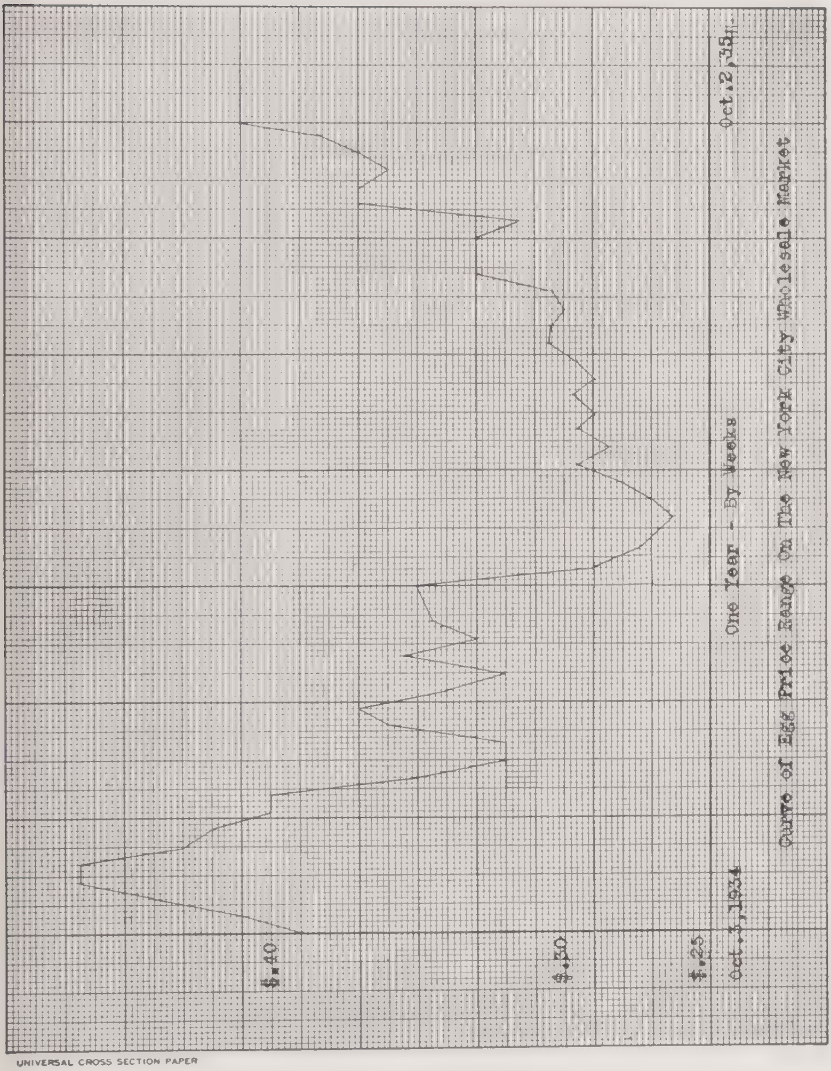

Fig. 7.—Yearly range of egg prices.

to the ready-to-lay stage of maturity and which are placed in flocks in laying quarters will live throughout the year. Mortality takes its toll month by month from every flock, even from the best.

This author, in Bulletin No. 591, N. J. Agr. Exp. Station, September, 1935, presented several aspects of "poultry mortality from a business viewpoint." He pointed out, in introducing the subject, that "In the poultry industry of this and other countries, during the past decade in particular, the percentage of mortality in both young and adult poultry flocks has been definitely increasing. Such increase in mortality rates is the cause of considerable worry to poultrymen. It means several things: first, the loss of the investment made in the individuals that died; second, the waste of time, equipment, energy, and general overhead in the handling of individuals that ultimately die; third, the loss of potential production and possible profit which might have accrued from the individuals, if they had lived; and, fourth, the reduction of efficiency among other members of the flocks by many of the factors or agencies producing the mortalities. Thus, from many points of view, the loss of birds at any age during the poultry year becomes immediately a more or less serious controlling factor to poultry farm profits."

Certain facts and figures taken from that Bulletin No. 591 of the N. J. Station establish the economic significance of the average poultry mortality rate as suffered by average egg producing flocks.

The summary of results of studies on the business

TABLE 3

SUMMARY OF RESULTS OF STUDY OF ECONOMIC HISTORY OF MORTALITY CASES IN S.C. WHITE LEGHORN FLOCK OF 4,930 PULLETS

Source of Stock—N. J. Egg-Laying Contests, 1928-1930	
Number of pullets in flocks at beginning of year	4,930
Number of pullets dying during first four months	282
Number of pullets dying during the spring months	344
Number of pullets dying during the summer-fall	329
Total number of birds lost during the year	955
Per cent mortality in flock during the year	19.6
Total number eggs laid by these 955 mortality cases	66,641
Total value of these 66,641 eggs	$2,287.78
Total value of food consumed by the 955 layers	$1,270.40
Profit over feed cost	$1,017.38
Mean egg yield of mortality cases for year	69.7 eggs
Mean egg yield of birds living through year	191.3 eggs
Difference, or lost potential egg yield, per bird	121.6 eggs

Note:—Data from Bulletin No. 591, N. J. Agr. Exp. Station, by permission.

significance of poultry mortality cases, as given in the above table, intimates the problem which is here presented. In measure as the poultry farm management in its entirety can keep the losses due to mortality to a minimum will the chances for best possible profits, other things being equal, be assured.

Mortality is not the only cause of decreases in poultry flock populations. Laying fowls, at least as found in the present day in use in the poultry and egg industry, are not so bred and constituted as to be capable of maintaining a uniform, even rate of egg yield throughout the year. Some individual birds "fall by the wayside," that is stop producing eggs, and become "culls." From the viewpoint of the business such non-layers, as soon as they appear as such in the flocks, are practically as valueless as mortality cases. They add nothing to the egg income of the farm. They do remain alive. They continue to eat and mount up further expense. They differ from the mortality cases chiefly in that they may possess some recovery value when sold as poultry meat. Under average commercial egg farm conditions in New Jersey it has been found that a ten-year average shows that flock decreases due to culling, on a monthly basis, may be expected to be approximately as follows: During 1st month of pullet laying year—0%, during 2nd month—2.5%, 3rd—2.5%, 4th—2.5%, 5th—3.5%, 6th—4.0%, 7th—4.0%, 8th—4.0%, 9th—6.0%, 10th—5.0%, 11th—5.0%, and during the last or 12th month—4.0%, totalling a reduction in flock population due to culling of 43%. This does represent a relatively heavy loss in laying population. It does, however, comprise all removals of fowls which were not producing eggs at a profitable rate.

Three graphic presentations of data from N. J. Bulletin No. 591 serve further to give a picture of the situation which arises in the average poultry laying flock during the year, and emphasizes the serious importance of flock decreases due to mortality agencies.

Figure 8 shows the distribution of the 955 mortality cases as to annual egg yields. For example, the graph indicates that out of the 955 fowls actually

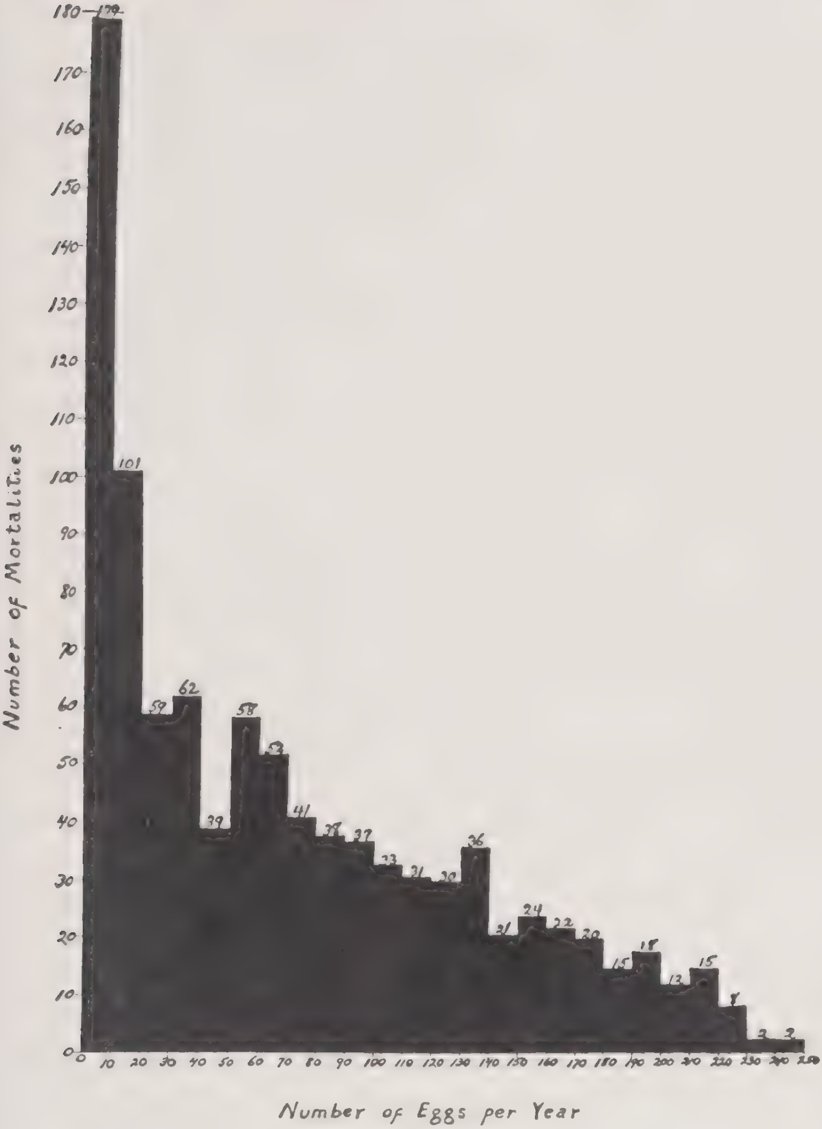

Fig. 8.—The distribution of the 955 mortality cases (S. C. White Leghorns), as to egg yield prior to death.

lost by death during the year there were 58 which had produced between 50 and 59 eggs, inclusive, prior to death, or, again, there were 18 which had produced between 190 and 200 eggs before dying.

Figure 9 shows the distribution of egg yields, on the other hand, of the 3,975 S. C. White Leghorn pullets which survived the entire first laying year—there having been 4,930 pullets in these flocks at the opening of the laying year on November 1st. This graph, in itself, offers something of a standard of flock egg yields which may be found useful as a

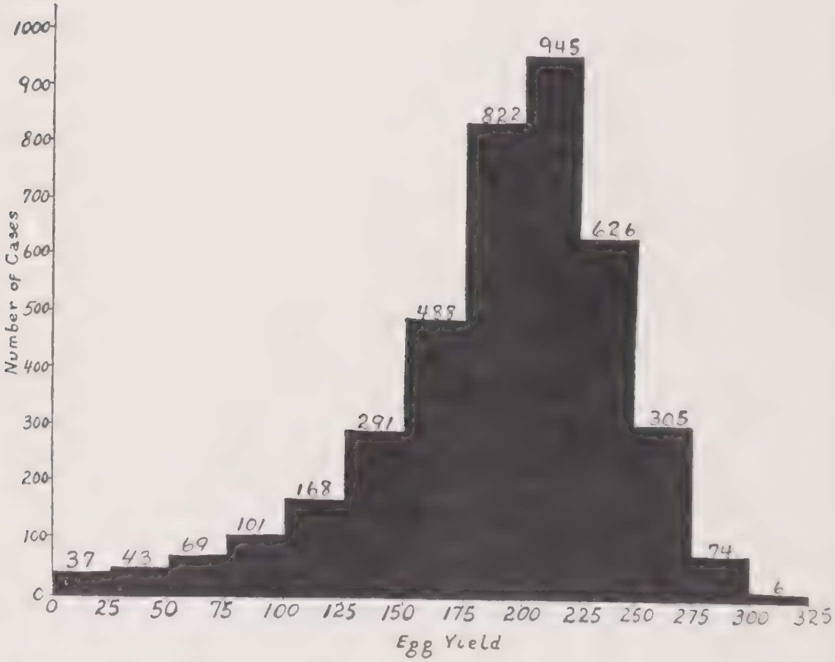

Fig. 9.—The distribution of the 3,975 S. C. White Leghorn pullets which lived throughout the first laying year, as to annual egg yield. (Grouped in 25-egg classes.)

measuring stick with which to determine the egg production performance of any given flock.

Another point of interest, bearing upon this problem of normal expectancies as to flock egg yields and subsequent profits, is to be found in the fact that in the usual flock there will be some birds which never produce any eggs whatever although they are surrounded by the same environmental conditions as are those which do render normal egg yield performances. The author found that out of the 955 birds which had died during their first laying year there were 72 individuals which never laid an egg, were 0-producers. Out of this number 37, or 51.4%, died during the first month of the year, but the others lived for varying lengths of time, as shown in Figure 10. By actual record these 72 0-yield birds consumed feed valued at $53.80 before they died, a total loss and waste, of course.

Good egg farm management must attempt to minimize the effects of this mortality factor as a limiting factor to profits by keeping as nearly as may be practically possible 100% of those layers which are placed in the laying quarters at the opening of the year alive and laying and in normal, natural health throughout that year. That is one of the most important challenges thrown out to any egg farmer in this present day. In large measure it can be met.

The main effort of this opening chapter has been to lay before egg farmers, prospective and practising, some of the business principles which should receive

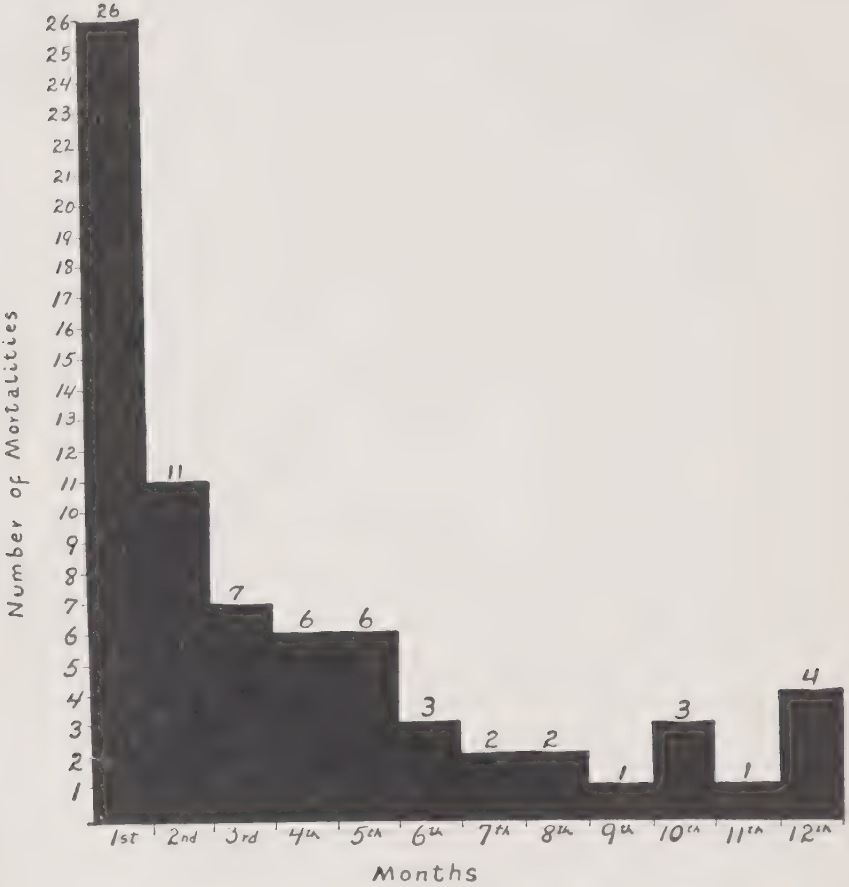

Fig. 10.—Distribution of O—egg yield mortality cases.

consideration whenever the business of producing eggs for profit is contemplated.

There are limiting factors to business success in egg farming, but there are corresponding limiting factors involved in every other sort of production enterprise. The egg production business is no exception to the rule. There are ways and means of counteracting these limiting factors, at least in part. There are methods whereby reasonable profits may be secured in the business of egg farming in spite of the existence of agencies which tend to work against such profits. It is the chief interest of this book to attempt to suggest such ways and means and methods of practical egg farming as will result in the reaping of reasonable profits. Education, experience, capital, improved quality of stock, better markets, cooperative effort, and better business methods applied to egg production all have a part to play in making egg farming an economically successful venture under present day conditions.

Egg farming is an agricultural enterprise which requires planning, but that planning must be done by the egg farmers themselves. It necessitates the adaptation of strict business methods to the operations which comprise table egg production.

Note: In the years which have intervened between the dates for these data, quoted from the N. J. bulletins, and the date of this revision, no material, or significant differences have appeared. 1949 data show similar relationships. This is an important observation, since it emphasizes the basic value of the contentions held in the discussions in this chapter.

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II

THE ECONOMICALLY USEFUL TYPES, BREEDS, AND VARIETIES OF DOMESTIC POULTRY

THE egg farmer is a producer, a manufacturer, an industrial operator of sorts. He is engaged in an enterprise the success of which is largely determined by the economy with which he can produce table eggs. He must manage production units, and those production units are hens. Just as in industry generally there are multiple types of machines which may be used, there are in the poultry industry today many types of hens which may be bred and managed for commercial table egg production. It is essential that the industrialist select his mechanical devices with care. It is likewise essential that modern egg farmers select the type, breed, and variety of hens to be used in a business-like egg-production proposition with care. It is not contemplated to discuss all breeds and varieties of domestic fowls in this book, but rather to look at breed and variety strictly from the point of view of the egg farmer.

Factors Determining Choice.—The factors which should guide the egg farmer in the selection of the type, breed, and variety of fowl which he is to use are strictly business phases, or should be.

1. *Market Demand.*—The egg farmer should attempt to furnish what his market demands, other things being equal. He must find out what his market does want. In this regard, he must ascertain whether or not the market which he serves is a "white-egg" or a "brown-egg" market, or if it will take either or both at approximately equal prices. If the market on which the bulk of his eggs are to be sold is primarily a brown-egg market, and brown-egg prices express that preference, the choice of breed becomes at once limited to such types as produce brown-shell eggs. If the reverse is found to hold, that is if white-shell eggs are distinctly preferred and better prices are paid for them, other breeds must be chosen. If either color of shell is taken by the market on essentially equal price bases, this factor is less actively involved in the choice of type, breed, or variety.

The leading breeds of fowls which produce white-shell eggs are those which have come from the Mediterranean countries originally, and which are known in the American Standard of Perfection as the Mediterranean Breeds. These include the Leghorns, the Minorcas, the Blue Andalusians, the Anconas, and the Sicilian Buttercups. These fowls all produce white-shell eggs. In each of these breeds there may be several varieties, with varying plumage colors or patterns or differing comb types. In very recent years several attempts have been made by American poultry breeders to produce a heavy type fowl which would produce white-shell eggs, amongst which the production of the Lamona, originated by Mr. Harry M. Lamon, is outstanding.

The principal brown-egg producing breeds of fowls include the several American breeds, such as the Plymouth Rock, the Wyandotte, the Rhode Island Red, the New Hampshire, the Chanticler, and others, the English breeds, such as the Orpington, the Sussex, and the Australorp, and the Asiatics breeds, including the Brahmas, the Cochins, and the Langshans. The latter group, however, scarcely belong in a category of egg-type fowls, since they are all heavy, meat-type birds.

These listings are not proposed as being complete, but rather pointing out breed types according to this matter of egg shell color.

Market demand, especially local retail trade, may dictate at times with regard to egg size, and differentiate economically between large and medium size eggs. In such instances a factor is introduced which sends the egg farmer to such breeds as the Minorca which by nature and inheritance produce large size eggs.

2. *Relative Demand for Products.*—The average egg farmer is not and probably should not be thought of as a poultryman who is not interested in the sale of some products of poultry breeding, over and above the table eggs which are his main source of revenue. The average egg farmer, as will be proposed later in these pages, must be a poultry breeder

as well as a table egg producer. The most economical egg farmer will be found to be that one who "produces his own" replacement pullets, and in connection with that process usually has some surplus of the products of his poultry breeding operations to offer to the poultry buying public. If that is the case, and surveys of modern egg farmers indicate that it is, the egg farmer must select his type, breed, and variety of fowl or fowls with due regard to the economical disposal of such products. Again, it will be good business to try to give the buyers what they want.

One has but to look around for a brief moment in any center of modern egg farming to realize that there are a few breeds and varieties which have been so widely accepted and adopted as to build up thereby a demand for such breeds and varieties as cannot be laid aside. The White Leghorn is observed to enjoy tremendous preeminence as a popular choice in egg-farming districts, particularly where the white-shell egg is preferred, such as in New Jersey, California, and the Pacific Northwest, not to mention the many other Leghorn centers. On the other hand, in such areas as the New England States, catering primarily to Boston-influenced markets, where brown-shell eggs are preferred, such breeds as the Rhode Island Reds, the Wyandottes, the Plymouth Rocks, and the New Hampshires have gained positions of great popularity and wide spread distribution. In such areas the demand for the products of poultry breeding operations will have to recognize market requirements and in turn dictate breed choices to egg farmers.

Missionary work on behalf of some lesser known breed or variety of fowls for a place in the sun of commercial egg farming is costly and probably must remain in the hands of such breed fanciers as have the time, patience, and real love of variety in poultry to give to the building up of popularity for their chosen types against the firmly established foothold of the now popular breeds and varieties. It is the claim of this writer that the average egg farmer, in the face of present day economic situations under which he is trying to make a business success of egg production, cannot afford to do such type of poultry breeding, except as a side line, or secondary enterprise. He must, in so far as is possible, deal with breeds or varieties for which there is a marked, well-established, and widespread, popular demand already in existence. This is not said in any spirit of lack of interest in the lesser known breeds and varieties of domestic fowls which have been developed so splendidly by poultry breeders in past years, but it is offered as a practical matter of considerable economic significance to the business-like egg farmers who are in their egg production enterprises for the primary purpose of gaining livelihoods for themselves and those dependent upon them.

This factor, in operation, tends to lessen the costs of selling or merchandizing the products of the plant. For example, within the Leghorn breed, the egg farmer finds within short radius of his plant probably hundreds of other poultrymen who want White Leghorn chicks, pullets, breeding cockerels, and the like, to every one poultryman who is in the market for Black Leghorn products. It is not that the latter has not the same potentialities as the former, but it is a fact that the White variety in this breed has become more widespread in popularity and use than has the Black variety. The egg farmer must ascertain facts and let them assist him, unswayed by sentiment.

3. *Availability of Economical Improvement Stock.*—Closely related to the previous factor is this one of the availability of new stock of inherently efficient quality whenever the need for introduction of outside or new blood is required for the best development of the farm. There are many instances, as well, when egg farmers desire to augment the supply of chicks or pullets which they have reared from their own stock with purchased stock. There are numerous instances in egg farming where the egg producers decide to depend more or less entirely upon eggs, chicks, or pullets purchased from off the place on which the commercial table egg production enterprise is being operated. The egg farmer cannot afford to hunt, usually laboriously and expensively, for such additional stock as he requires. He needs to be able to find it close at hand. And, not only that, but also to find sufficient sources of the desired type of stock to allow some choice and selection to be indulged in at the time of purchase. This

factor is highly important. It does, of course, tend to strengthen the case for those types, breeds, and varieties of fowls which have attained considerable widespread popularity at the present time, especially where that preeminence has been due to economic worth and dependability, such, for example, as is undoubtedly true in the case of the S. C. White Leghorn. But such effect is inevitable. The student of poultry breeds cannot remain blind to the obvious fact that in so far as the commercial or business type of egg farming is concerned the tendency is decidedly toward a narrowing down of the number of breeds and varieties being used in the industry.

4. *Adaptability of Fowl to Type of Enterprise to be Operated.*—This book is dedicated to egg farming. It does not lay claim to the other fields of poultry keeping. In this matter of breed selection,

Fig. 11.—A flock of Barred Plymouth Rocks bred for efficient egg yields.

therefore, the point of view of the egg farmer is maintained. The type or breed chosen should, by its very nature and inherent tendencies be adapted to the primary purpose of egg production. It was for this reason that the Asiatics were eliminated in the paragraph above. The egg farmer gains immeasurably by starting off with a fowl which is essentially bred for the specialized function of heavy and sustained egg production. Do not ruin a splendid meat breed, like the Jersey Black Giant, or the Light Brahma, or the Dark Cornish, by trying through trapnesting and other devices to make it over into an economical egg producer, for it usually results in ruining the meat breed as such without actually producing an efficient layer of eggs. Select a type and breed which is already in existence as an egg type and in which there are eminent strains or families of efficient egg producers.

In practice, then, this point means that the egg farmer's choice is limited to those breeds, such as are found in the Mediterranean Class, which are inherently egg type, or those breeds in the dual-purpose groups, such as the principal American or English breeds, in which notably efficient strains of egg producers have been developed.

5. *Personal Liking.*—The element of personal favoritism is not to be left out of consideration. It is a mistake, in the mind of this writer at least, to select a type of fowl which does not stir up some thrill, or joy, or personal response which is pleasurable, since the field for selection is sufficiently wide to permit of

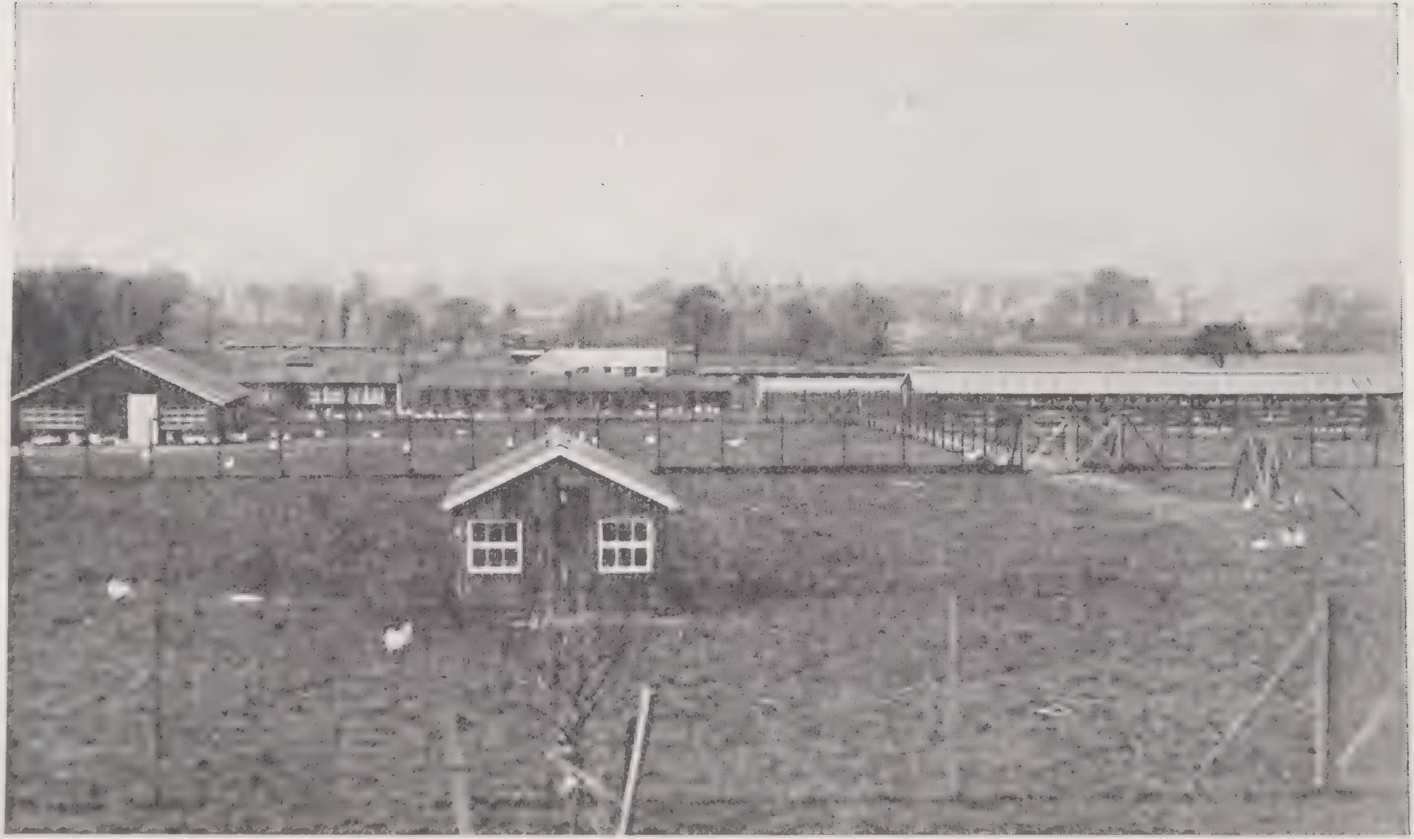


Fig. 12.—A view of the National Institute of Poultry Husbandry, and the Harper Adams Agricultural College, Newport, Salop, England. The author acted as the first director of the Institute, 1924-1926.

choosing one which will please the personal element involved in the case. It is usually true that the egg farmer who personally likes the Barred Plymouth Rock, for example, much better than he does the White Leghorn can and will do better with that breed of his personal liking than he ever would with the other. Other things being equal, it is permissible even from a strictly business point of view to indulge this factor of personal liking to at least some degree. If it were not for the working out of this factor in the poultry industry as it is today, it is probable that egg farming would consist, as to breeds, of only two or three types.

6. *Special Features Possessed.*—In some local situations and for some markets certain special features possessed by some breeds of fowls must be a determining set of factors. For example, if the local market likes and prefers a white-skinned fowl, choice would at once be centered upon some breed of English origin, such as the Sussex, which would furnish that specific feature desired. The insistent demand for white-feathered broilers in some places eliminates consideration of other than white varieties, and, likewise, in other sections where decided preference has been built up for barred broilers choice of breed at once becomes limited to the Barred Plymouth Rock.

7. *Breeding Back of Fowl.*—When the egg farmer comes to the important matter of actually choosing breed or variety to be used in a business enterprise, he must look well to the background of the fowl

under consideration. Have many breeders been working with it? Have they applied sound breed improvement methods to its development over several years? Has there been any material mass of production within the breed, thus demonstrating its proved usefulness in the industry? Or, on the contrary, has comparatively little been done toward its material improvement in efficiency as an egg producing type of fowl?

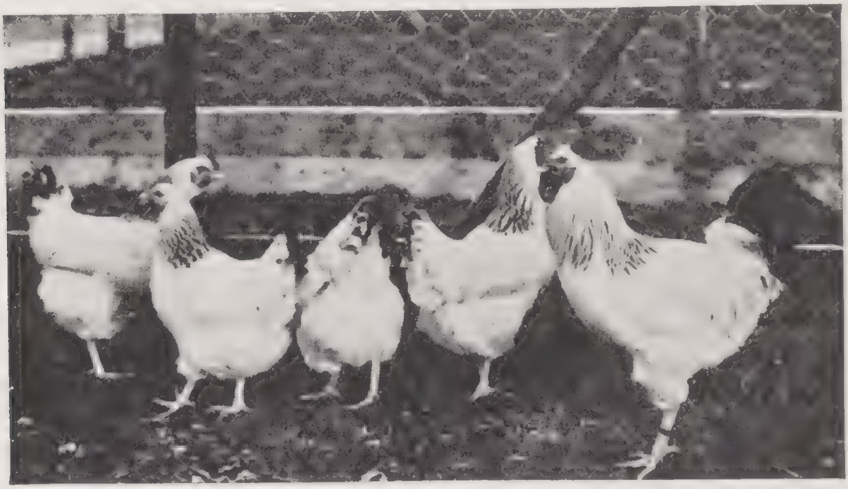


Fig. 13.—The Light Sussex fowl has been developed as one of England's greatest general purpose and egg producing varieties of domestic fowl.

One cannot escape finding such breeds as the Single Comb White Leghorn, the Barred Plymouth Rock, the Single Comb Rhode Island Red, and the New Hampshire, considerably in the vanguard from this point of view. There are thousands of breeders who have been exercising more or less sound, usually more, improvement methods within such breeds as these, while for many other breeds or varieties of similar potentialities far fewer breeders are to be found who have given to those breeds the same degree of improvement which has been given to the more popular types mentioned. The listed contestants in the American egg laying contests give evidence of where interest has been centered in this matter of wide breed improvement.

Classification of Poultry Types, Breeds, and Varieties.—The egg farmer should be familiar with those standard methods of classification of poultry breeds and varieties which are usually employed, in order that he may read his poultry papers more intelligently and in order that he may understand the fowls of his own choice more completely. It is not essential that he study details, and such are left for other types of poultry books to deal with. Here, just an outline!

There are two methods of classification of modern breeds and varieties of domestic fowls: the Standard method, and the Utility method, unofficial in character in that no organization is backing it, which is based upon the usefulness of the fowls.

The American Poultry Association maintains an official standard for the breeds and varieties of domestic fowls which it has recognized as pure bred and deserving of permanent place as established types. This standard is published under the name of the American Standard of Perfection. Basically its breed classification is used throughout the American poultry industry. It is one of the finest contributions yet made to the development of modern breeds of poultry, and has been one of the most effective influences in creating for American poultry industry products, eggs, meat, chicks, and the whole gamut of products, a degree of uniformity and evenness of quality that is probably not surpassed anywhere in the world and is equalled in few places.

The Standard of Perfection classification, fundamentally, divides all breeds into classes, mainly on the basis of origin. The egg farmers are primarily interested in the American Class, the Mediterranean Class, and the English Class of pure bred fowls, because in those three classes are to be found the principal breeds commercially used in egg farming. In the American class are to be found those well-known breeds which form an integral part of modern egg farming, the Plymouth Rocks, the Wyandottes, the Rhode Island Reds, the New Hampshires, and the Chanticlers—dual-purpose breeds which have, in many instances, been bent toward the egg production extreme so far as to make them even competitors with Leghorns for use on table egg production farms. As has been suggested before, the English Class is strikingly similar to the American in that it includes dual-purpose types of fowls which have, in their own land at least, been developed keenly as egg producers. In this Class are to be found the Orpingtons, and the Sussex, both valuable breeds in the present day egg production industry of England, and both found to no mean extent in America. The

Mediterranean Class includes two groups of breeds, those of Spanish origin, and those of Italian origin. In the former are the fine old breeds of Castilian descent, the Minorcas, and the Andalusians, both renowned through many years as producers of exceptionally large and extraordinarily white-shell eggs. In the latter, of course, are the whole Leghorn and Ancona families, as well as the Sicilian Buttercup type.

Within each Class, as has been indicated, are various breeds, differences between which are matters of body shape, form, and size, items which make up type very largely. Differences between Plymouth Rocks and New Hampshires, for example, are differences in body weight and general shape and form of body.

Within each Breed are divisions into Varieties, based upon color or pattern of plumage, and or comb character.

The present set-up within the three Classes which are of immediate interest to egg farmers is as follows:

1. American Class.—including fowls mainly of American origin and of a type especially adapted to American farming conditions and needs.
    - A. Plymouth Rock Breed—a general purpose type, in which many strains or families have been developed for heavy egg laying.

a. Barred Variety—one of the earliest to be made, and one which leads in popularity throughout the country, being well adapted to general farm requirements, to broiler production, and to egg farming where brown-shell eggs are desired. (see Fig. 11)

b. White Variety—another popular Rock, specially liked for meat production, but not as widely popular for egg farming as the Barred variety.

c. Buff Variety—like the others in form and size, this variety differs only in color, its rich, golden buff being loved by many breeders—has not been popularly reared for egg production purposes, and relatively few flocks are available.

d. Columbian Variety—similar to the other Rocks in every way except color, this variety has the black and white plumage pattern of the old Light Brahma—good laying strains have been bred, but not numerous.

e. Partridge Variety—Golden penciled in pattern, and beautiful in shade and design, this variety has not figured very largely in commercial egg farm development.

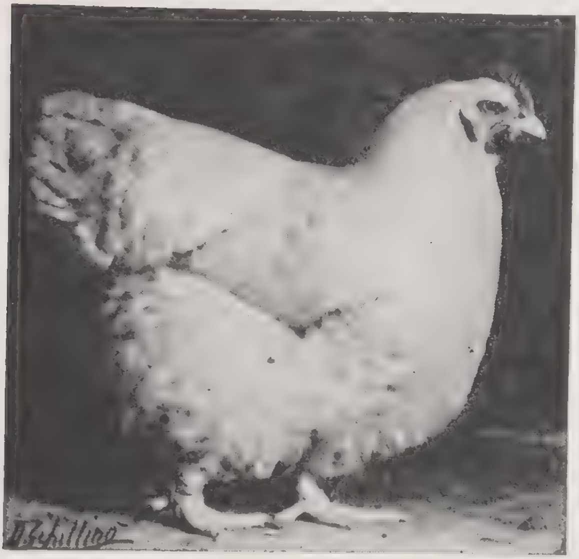


Fig. 14.—Breeds other than the Leghorn have made excellent records in egg production: as this White Orpington, bred and owned by Mr. J. I. Lyle, Plainfield, N. J.; pullet year record of 301 eggs.

f. Silver Penciled Variety—like the Partridge, except that the markings are in white, or silver, and black, rather than in mahogany and black. Not a factor in egg farming.

g. Blue Variety—least known of the Plymouth Rock family is this smoky blue member, and entirely unknown to the egg farmer.

B. Wyandotte Breed—not unlike the Plymouth Rock, but usually somewhat rounder and a bit more compact than its competitor, and about a pound less in weight, bred, however, for the same purposes, one of which is efficient egg yields. This breed is divided into varieties, as listed below, with the White Variety as the principal one of interest to egg farmers.

a. White Variety.
b. Black Variety.
c. Buff Variety.
d. Columbian Variety.
e. Silver Laced Variety.
f. Golden Laced Variety.
g. Partridge Variety.
h. Silver Penciled Variety.

C. Rhode Island Red Breed—a well-known breed which has found wide usage on American egg farms, as well as on the general farms of the country.

a. Single Comb Variety.
b. Rose Comb Variety. It is the Single Comb type, however, which has been used largely in modern egg farming.

D. Rhode Island White—Rose-combed, like the Red in form and size, but possesses white plumage, and useful in similar manner to that of its Red sister breed—not yet widely used.

E. Dominique. Barred. and rose-combed. one of the oldest of American breeds. but not a factor in modern egg farming.

F. Buckeye Breed—Pea-comb. Red in plumage. and like the R. I. Red in many respects. but not longer a factor—still remains in the Standard.

G. Chanticler Breed—A Canadian type, originated for the cold climates of upper Canada. with small flat combs. and a form suggesting the admixture of Cornish blood at some time—not seen to any extent in the States.
   a. White Variety.
   b. Partridge Variety.

H. Lamona Breed—a White breed. originated by H. M. Lamon. and proposed as a general utility breed producing a white-shell egg. Not well known or distributed as yet—a breed of such characteristics has future possibilities. however.

I. Java Breed—important seventy-five years ago.
   a. Black Variety.
   b. Mottled Variety.

J. Jersey Black Giant Breed—developed in central New Jersey primarily to furnish a breed especially adapted to capon and roaster production

K. New Hampshire—a modern, chestnut red utility breed, originating in New England.

This outline of the Standard Classification of American breeds gives to the egg farmer a picture of that group out of which he may find several notably efficient egg producing types of fowls for use in the development of his egg production enterprise. All, except the Lamona, produce brown-shell eggs, and all are medium to good meat producers as well as good egg producers. Broodiness has been bred out of most of them to a large extent, and these races are, as a whole, quick to mature, hardy, efficient users of grain, and splendidly adapted to the needs of the modern egg farm, other things being equal.

2. ENGLISH CLASS.—including fowls mainly of English derivation and of a type quite similar to the dual-purpose type found above in the American group of breeds and varieties. Only three of the English breeds are of economic interest to American egg farmers, the Orpingtons and the Sussex and the Australorps.

A. Orpington Breed—large, general purpose in type, and producers of brown-shell eggs.
   a. White Variety.
   b. Black Variety.
   c. Buff Variety.
   d. Blue Variety.

B. Australorp Breed—the Black Orpington

was taken to Australia and there developed as a table egg producing breed, with resultant changes in size and form which now separate it from the parent stock. It is well known especially in California and other western States.

C. Sussex Breed—a very modern dual-purpose breed, arising in southeastern England, of which the Light, the Red, and the Speckled Varieties are of recognized standing in America. (see Fig. 13)

D. Other English Breeds include the Cornish, the Redcap, and the Dorking, none of which are of economic significance in the American egg farming industry.

Most of the English fowls have white skins and produce brown-shell eggs.

3. Mediterranean Class.—strictly egg type in all of its members, and all white-shell egg producers.

A. Leghorn Breed—light, active, nervous in temperament, non-broody, rapid in growth, hardy, and highly developed in the function of egg production. The leading egg production type of domestic fowl in the world today, without fear of argument, in numbers and popularity.

a. White Variety (Single Comb)—the great egg type fowl for the American egg farm wherever white-shell eggs command a premium or can be disposed of to equal advantage with browns. It does stand each of the seven tests which have been suggested as factors to be considered in the choosing of a type, breed, or variety for American egg farming.

b. Other Varieties, include beautiful specimens like the Browns, the Buffs, the Silvers, the Blacks, etc., each of which has the same size and form as the Whites, but none of which have caught the public's high favor to the same extent as have the Whites, and therefore none of which have such vast masses of breeding and selection back of them as have the Whites.

B. Minorca Breed—large, angular and rangy, white-skin, and producers of large, chalk-white eggs, with beautiful symmetry of form and elegance of appearance.
   a. Single Comb Black Variety—the leaders within the breed.
   b. Rose Comb Black Variety.
   c. Single Comb White Variety.
   d. Rose Comb White Variety.
   e. Single Comb Buff Variety.

C. Andalusian Breed—very like the Minorca as an egg producer, and in body type.
  a. Single Comb Blue Variety.

D. Ancona Breed—closely similar to the Leghorn breed.
  a. Single Comb Mottled Variety.
  b. Rose Comb Mottled Variety.

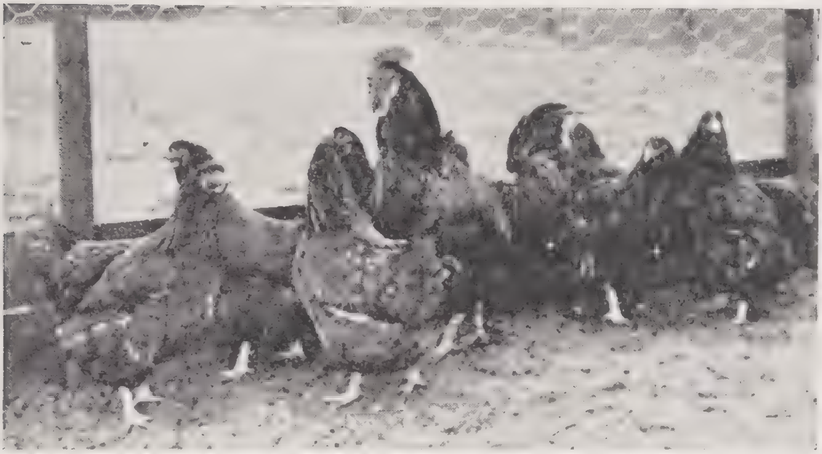


Fig. 15.—A mating of "Rhode Islands," as they are called in England, used by the author in his work at the National Institute of Poultry Husbandry, Newport, Salop, England.

E. Sicilian Buttercup—with its white skin, and type which might be a mixture of Italian and Spanish types, and its gay, yellowish plumage is a relative new-comer to America, and but few flocks have as yet been established.

Now, these brief outlines, based upon the arrangement suggested by the American Poultry Association, to whom all credit is given, suggest the places where egg farmers may expect tc have to go to find types and breeds of fowls adapted to their specific needs. For detailed descriptions of Standard qualifications the Standard of Perfection must be consulted. Every poultry breeder should become familiar with Standard quality for the breed of his choice, and should never leave out of his considerations those characteristics which have been established for that breed before the world. Ultimately his success will depend in part at least upon his ability to keep his fowls up to a high degree of perfection according to Standard ideas and ideals, for in that way a high degree of uniformity of products is maintained. That is important in egg farming. Standards have been changing through the years, and can again change as future needs arise, for there are ways and means of accomplishing this in the very body which originally produced and has been maintaining the Standard of Perfection. Egg farmers must voice their opinions from time to time and see to it that the breeds and varieties which they use most frequently and effectively are kept up to a workable and efficient standard.

Briefly, the second classification, the one based upon utilitarian values, which the egg farmer might use in getting this matter of breeds and varieties properly aligned is as follows:

I. Egg Type.—including all breeds and varieties, regardless of place of origin, which possess similar body characteristics which in the aggregate tend to build a type of fowl specifically adapted to high egg production functioning. The Leghorns, Anconas, Minorcas, Andalusians, and Sicilian Buttercups are notably in this utility class, the egg type. They are all active, nervous in temperament, non-broody, close-feathered, small in body (comparatively), quick maturing, hardy, and efficient in turning food consumed to the end of egg formation.

II. Dual-Purpose Type.—including all breeds and varieties which are good, both for meat production and for egg yield, but not highly specialized in either field. They are medium in all of points above mentioned. Certain strains or families within these breeds, however, have certainly become truly representative egg type fowls, and probably such a circumstance is to be expected.

In a book of this type, such a question as that of breed should be definitely answered and specificially answered in so far as may be possible, for it is assumed that the reader wants to know, after all, which breed he should choose.

A summation of the considerations which have been presented on this question of breed might be made as follows:

1. In choosing a breed or variety of fowls for use on an egg farm, definitely subject each possibility to some such test as that above suggested, the seven factors involved in choice of breed. See how each lines up under each of those points, and be governed quite largely by such results, for, after all, they are the business features which will have much bearing upon future results.

2. Carefully weigh the chances of new breeds or varieties becoming close competitors of those which are already well established. If one has time or inclination to do that ground work which is essential to the broad establishment of a new breed or variety in the industry, well and good, but it should be definitely understood that costs not chargeable to table egg production will accrue. There is a very definite question abroad in the land as to whether or not American poultrymen need more or fewer types, breeds, and varieties of commercial fowls.

3. Consider as to whether or not more than one breed is to be kept. If more than one is to be maintained, the choice may be broader and more inclusive.

4. Within each breed or variety there will be found strains or families which have been the result of line-breeding and careful selection for several generations for specific purposes. Emphases have been laid upon those characteristics which are of greatest value in egg farming, in most instances, at least. Strain is of greater significance than breed or variety, as a rule. Always inquire most meticulously

about the line of breeding and methods of breeder selection toward egg yields which have been in practice, for they are of infinitely greater significance than differences in form of comb or color of feather.

5. For areas catering to a white-shell egg market, generally speaking there can be little doubt but that the Single Comb White Leghorn is the type, breed, and variety which most efficiently and economically meets the tests for a fowl suited to commercial table egg production under present day conditions. It would be dodging the issue clearly to say otherwise. It is not minimizing the importance of all other breeds and varieties in the American poultry industry, but it is recognizing the unique place which this one variety has forged for itself in the egg farming side of that industry at the present time.

For areas definitely desiring brown-shell eggs, probably first selection must be given to the Rhode Island Reds, the New Hampshires, and the Barred Plymouth Rocks, and similarly, the value of all other heavier types of fowls is not minimized hereby. The situation is developed and egg farmers should face facts and benefit thereby, if possible.

This limited and rather specific recommendation with regard to breed and variety for egg farming leaves a wide range for use in all other phases of modern poultry keeping. The writer has had hundreds of letters from prospective egg farmers during the past twenty-three years relating to their quandaries as to this matter of choice of breed and variety. For some the choice may wisely be made over a wider range than has just been named, but for the rank and file this narrow range of choices is undoubtedly wisest. It is in reality experience expressing itself and saying that there are sound and valid reasons why certain few of our pure breeds and varieties of domestic fowls have plowed ahead of others and have attained positions of economic advantage in this present day. It is saying that because these specific developments have taken place that these few types have become of greater economic usefulness than the others which have not similarly enjoyed mass production and therefore mass selection and mass improvement.

Present-day egg farmers are not in the position of some of their forebears, that of having to build up suitable and efficient fowls for use in their egg production venture or business. American poultry has passed through that stage. It is now possible for any person desiring to go into the business of egg farming to start off with efficient types, breeds, or varieties of stock, choice to be made from already existing developments. This is a great advantage for modern egg farmers.

III

POULTRY LAYING FLOCK IMPROVEMENT

In egg farming there is just one major objective to be accomplished through the setting up of a systematic poultry breeding program for flock improvement, and that is to furnish egg production units which will be efficient and economical. Each layer contributes a certain share to the general economy of the egg production plant, and that share may be such as to earn a profit or the reverse. When the egg farmer fully appreciates that every individual layer in his flocks is a separate and active factor either for profit or for loss he is in a position to appreciate the actual business necessity of employing a layer-improvement, that is a breeding program as a regular part of the farm management. Experience has demonstrated that many of the characteristics of fowls which have some influence upon their egg-laying capacities are more or less readily controlled by heredity, and therefore are subject to control by breeder selection. Without some continuously operating scheme of breeder selection at work each season the egg production levels of the pullet flocks will always seek to return to the average for the species, and that is not high enough to enable egg farmers to realize a reasonable profit. Poultry flock improvement must be constantly planned and practiced in order that egg yields may be raised to and maintained at profit-making levels.

It costs the egg farmer practically as much to feed and maintain a layer of low or medium egg laying capacity as it does to keep and provide for a layer of high egg yield proclivities. The aim of the egg farmer should be to populate his flocks with layers which will all earn profits on eggs laid. In part, this is going to be accomplished through breeder selection, the production of layers from parentage chosen according to egg-production tendencies. The higher egg yields which are secured through breeding methods are, as a rule, secured at relatively low costs. Poultry breeding may become a very economical means of increased egg output.

The Problem of Layer Replacement.—The egg farmer's hope of business success lies very largely in his pullet laying flocks. As has been said before, they are the production units in his enterprise. Egg farming consists of managing quickly succeeding laying flocks. Each fall brings its new pullet flocks. The production units are annually being changed. This is an unique characteristic of poultry and egg farming, but it creates a specific problem, the problem of economically and efficiently replacing the layers on an annual basis. It may be readily seen that such frequent changing of the production units must have a direct bearing upon the business character of the undertaking. There is no one more important factor in economical egg farming under modern conditions than that of "layer replacement."

Layer replacement and layer improvement might well be considered under the following points:

1. *The Cost of Replacement Layers.*—Each fall the egg farmer fills his laying houses, to their full capacity if possible, with the hens and pullets which are to be the egg-producing units of his business for the coming year. This re-arrangement of flocks each fall is an inevitable part of the year's program. During every year some layers die and others have to be culled out as unprofitable producers. There are bound to be certain flock decreases on every egg farm during the year. There is bound to be, therefore, a necessity for replacing a certain percentage of the laying flocks each fall. If each replacement layer can be placed in laying quarters at a comparatively low actual cost, it is readily discernible that the capital investment made in the laying stock, in the production units of the plant, for the oncoming season will be lowered and the interest which has to be figured on capital used will be lessened. Other things being equal, the first great step in egg farm management economy is to be found in the holding of "the actual cost of replacing a laying fowl" down to a minimum. If only a few cents are saved on each new layer added to the flocks, the aggregate accumulating on the farm as a whole becomes an important item.

There are several ways through which replacement layers are to be secured on the modern egg farm. In some instances one way will be mandatory, while in others different schemes of securing layers will be found necessary. In every instance, however, an attempt must be made to use such scheme of layer replacement as will put those layers in the laying quarters at least possible actual cost. A weak spot in the set-up of many egg farm ventures has been in this particular place. The egg farmer has not sufficiently considered the direct and immediate effect upon his business of not paying strictest attention to the cost of his replacement layers each fall. Whichever of the available ways of securing replacement layers is made use of, the same basic principle remains urgent, that of keeping the initial cost of the egg yielding units, the laying stock, down to least possible costs, consistent with desired quality.

a. *Buying Ready-to-Lay Pullets.*—There are many occasions when the egg farmer must rely upon purchasing ready-to-lay pullets, at about twenty to twenty-four weeks of age, in order to fill his laying house equipment for the season. In some instances this method may be used as a sole means of securing layers. In other cases, it will be used as a means of augmenting pullet flocks reared on the plant. The point here is, however, that in modern egg farming there is considerable use made of the established practice of transferring ready-to-lay pullet stock from place to place. From the standpoint of cost, which is the present viewpoint under discussion, this means of layer replacement is probably the most expensive.

Obviously, if the poultry industry is to be continued on a firm business basis, the producer of ready-to-lay pullet stock is entitled to a reasonable profit. The buyer is in the position of having to pay a figure which is determined by the actual cost of production plus this reasonable profit. The possibility of securing ready-to-lay pullet stock is a boon to many persons who are engaged in egg farming. That is not to be forgotten. The use of this method of securing replacement layers as a steady practice must be done only when one fully appreciates its relative economy amongst the various possibilities.

In anything like normal times, in the New Jersey egg production industry, it would be reasonable to assume that one would have to pay somewhere between $1.50 and $2.50 per pullet for such ready-to-lay stock—as a concrete example of actual cost figures. Of course, this price will vary widely. There is no set market price for ready-to-lay stock which controls the country as a whole. During the few years since 1930 it is probable that midway between the prices indicated above might represent the average price secured.

Later in this book the subject of when to depend upon ready-to-lay stock economically will be dealt with. In this place, the higher cost which must prevail for such a means of filling the laying houses is simply pointed out.

b. *Buying Squab Pullets.*—Considerable interest has been manifested in recent years in the production of a surplus of chicks over and above the numbers which might be satisfactorily reared on the given plant, with the definite purpose of disposing of that surplus in the midst of the growing season. Such young pullets have been variously called squab pullets, 14-weeks-old pullets, half-grown pullets, etc. We shall refer to them here as "squab pullets," and mean by the term those pullets which have reached an age of something like twelve to fourteen weeks and have been completely weaned from artificial heat and are ready to complete the growing period in unheated houses. Such squab pullets are usually available from mid-June on through August. Prices in New Jersey, for example, have, in normal times, ranged from about $0.75 to $1.50 per bird. Generally speaking, it will probably be found that it will cost something like $0.40 to $0.50 per bird to carry squab pullets on through to ready-to-lay maturity.

If the egg farmer has an abundance of room and equipment at hand with which to finish maturing young pullets at reasonable cost, it may very well be that to secure replacement stock in the form of squab pullets may be an economical way of doing it. Circumstances must determine the advisability of this procedure.

c. *Buying Day-Old Chicks.*—A very frequently used means of providing for future layers is, of course, the purchase of stock in the form of day-old chicks. If ways and means of rearing chicks on the egg farm are at hand, it is probable that this means of providing further future layers will be found to be more economical than either of the two previous methods just discussed. It does require, however, that brooding equipment be at hand and that time and effort be expended throughout the spring and summer seasons. The ultimate cost of laying stock reared from purchased chicks is approximately two-thirds that experienced in the purchase of ready-to-lay stock, although this figure will vary widely in different parts of the country.

d. *Breeding and Rearing Replacement Layers.*—Under average conditions there is little doubt that the lowest cost replacement layers are secured through the process of breeding, hatching, brooding and rearing one's own stock, for surveys of existing egg farms again and again show that pullet layers can be produced on the home plant and put into winter laying quarters at costs which will run about 65% of the average market prices prevailing for ready-to-lay stock. From a strictly business viewpoint there is much to be said in favor of the establishment of the general practice of raising one's own replacement pullets. In this place the item of differences in costs alone is up for consideration. As will be shown later, there are other strong arguments in favor of breëding one's own replacement stock.

2. *The Efficiency of Replacement Layers.*—The initial cost of layers which replace mortality cases or culls or which increase the numbers of laying flocks in any fall season is, however, not to weigh too heavily, for it is only one factor. A second, and an

exceedingly important and significant one, is found in the efficiency of laying stock secured. Each season should see some improvement in the laying flocks. This improvement should be found in:

a. *Increased Egg Yield Per Year Per Layer.*—The egg farmer makes his money on the gross egg output of the flock, one useful measure of which is this average egg yield per year per bird, and not so much on the star performances of a relatively few outstanding high yield individuals. One cannot expect to get a high average egg yield from laying flocks unless the individuals within those flocks have been bred from high egg production tendency parent stock.

Fig. 16.—White Leghorn squab pullets prove to be good business for both producer and buyer.

There must constantly be selection and directed mating back of good pullet layers, whether they are secured by purchase or are produced on the place. If the producer of pullets has done a good job in his breeding operation and in his rearing work, the resultant layers will be good, but if non-descript methods have been used and the only attempt has been to produce pullets to sell, the resultant layers are not to be depended upon. The egg farmer must realize this situation and must insist upon securing efficient replacement laying stock. He is usually "licked before he gets started" unless he does do this. Too many failures in egg farming have been directly traceable to a failure to secure efficient stock when replacement pullets have been secured.

Under average egg farm conditions it is probable that the average pullet layer must produce approximately 100 eggs in order to pay all legitimate charges against her for the year, and, therefore, any egg yield over and above that hundred may usually be counted upon as mostly profit. It is reasonable to contend that the comparative profits of the laying flocks will be proportionate, therefore, to the degrees to which their average egg yield per year per bird increases beyond that 100 mark. If breeding and selection will tend to help, at low cost, to raise the egg production per year per bird appreciably above the number required to meet costs of maintenance, the possibilities of profits are immediately enhanced.

First, last, and foremost at all times in the egg farmer's management program must be provision for maintaining and increasing the egg production tendencies and inherent capacities of the layers. There is no place on the modern egg farm for the non-efficient layer, for the fowls which produce few eggs. Inefficient egg production units work against profits directly, quickly, and effectively. That there are, unfortunately, all too many inefficient fowls populating many modern and existing egg farms proves nothing except that there is much room for further improvement in this industry.

3. *A Longer Life of Egg Yield Efficiency—Longevity.*—For many years it has been a rather common practice on egg farms to keep over for a second year of management for egg yields only approximately one-half of the fowls which were put into laying flocks as pullets at the beginning of the previous year, and to retain few, if any, fowls for egg production purposes beyond the second laying year. This has meant that the industry, as a whole, has had to replace from one-half to three-quarters of its entire laying population each fall. Such heavy turn-over has been costly, for every new pullet must be paid for by the year's business. The suggestion here offered is that egg farmers may well look toward ways and means of reducing the numbers of layers which will have to be replaced each season in order to secure profitable egg yields. Breeding for longevity, that is for prolonged economical egg yield, has been definitely demonstrated to be possible and feasible. Every hen which may be carried over beyond the second year in health, strength, and continued egg-

producing condition does away with the cost and expense of rearing and providing a new layer. The egg industry will be safer in measure as it tends to provide itself with layers which will prove to be economical producers of table eggs somewhat beyond the allotted two years of present day practice. This is probably largely a breeding matter. Fewer annual replacements because of the existence of more layers capable of prolonged egg yield would prove to be sound economical management.

4. *Reduced Rate of Turn-Over of Laying Stock.*—One of the causes of reduced profits on many egg farms is to be found in the large number of layers which have to be replaced each year, in the excessive number of those which do not remain economical layers for even the majority of time during their first laying year. The graphic chart which was presented as Figure 8, page 47, bears further study in this present regard. It intimates the degree of turnover which the egg farmer is often meeting with and which he must mend in order to insure better economy in his table egg production in future days. He must *keep more birds alive and laying!* A practical objective to set up as a goal might well be—"To breed flocks of layers, and to so manage them as to keep as nearly as may be possible 100% of those which are considered good enough to put into laying quarters in the fall of the year alive and actively productive throughout the entire business year." This, at least, is a part of the problem of economically maintaining an egg-producing flock which will

be capable of earning profits. Too much emphasis cannot be placed upon the significance of planning the egg farm most carefully with regard to this factor of layer replacement.

It is to be admitted that profitable egg production is not entirely a matter of inheritance, of breeding, of hereditary influences, for every observer of the modern egg farm sees that environment and management factors enter into the proposition along with inheritance. It is suggested, however, that fundamentally and beneath all management practices there must be sound breeding methods, for, after all, the egg farmer is dealing with living organisms, not mechanical devices, or man-made machines, and the natures of those living organisms are very largely determined by inheritances from ancestral individuals.

Practical, Economical Poultry Laying Flock Improvement Methods.—Volumes have been written on the principles underlying poultry breeding. Chapter after chapter might be written here on one or another of the phases of breeding which directly bear upon egg farming. And yet, the object of this book is to present workable plans for procedure. Therefore, now, it is suggested that in as few words as possible there be set down certain schemes of breeding for increased egg yields and bigger profits which in practice have worked and which are based upon scientific investigations of recent years. From other sources may be gleaned details not furnished here.

1. *On the Egg Farm where no Trapnesting is Done.*—Poultrymen have come rather universally to believe that flock improvement must be based upon the use of selected individuals, both male and female, as breeders from which further laying flocks are to be produced. This idea has taken firm root, and it is well that it has, for the premise is sound. Improvement will take place only when poultry parent stock is painstakingly examined and selected and mated with regard to possession of those characteristics which are known to be associated with egg production capacity of superior degree. Poultrymen, further, have recognized in the trapnest and the individual egg yield record devices which work efficiently in establishing the essential facts upon which to select stock for breeding and reproduction purposes. Poultrymen have been trapnesting and recording egg production performances for many years, and thousands upon thousands of cases have been studied. It would seem that the time had come when such almost infinite cases might have established certain facts which might be useful in the building of simplified and less expensive methods of breeder selection. At any rate, one finds many instances in the poultry industry where poultrymen are completely convinced of the advantages and real worthwhileness of trapnesting and the use of actual records of egg production as means of breeder selection, but wherein it is not deemed economically possible to employ those methods. In other words, there are commercial egg farms, producing their

own replacement stock, which desire to do the best they can without use of trapnesting or individual recording. Is there a way?

a. *The Blue-Banding System of Breeder Identification.*—For several years the writer, in his work at the New Jersey Agricultural Experiment Station, has been suggesting the system which he has called the "blue-banding" system. It is here repeated and advocated as a sound, workable, simple, and easily applied scheme of poultry breeder selection which is based upon what has been learned in the years through employment of the trapnest and pedigree record and which itself does not use these methods. It may be applied to each and every egg producing plant without increasing the cost of overhead management appreciably. Its plan, without going into long and exhaustive arguments concerning the scientific bases upon which it is constructed—only affirming that such exist and have been published widely in recent years—involves, concretely:

1. As each lot of chicks is placed under the brooders, mark with designated toe-punches each individual so that a permanent and inerasable record is maintained on the chicks themselves as to "date of hatch." For example, mark all chicks hatched on March 1st with an outside left toe-punch, and thereafter whenever individuals from that date of hatch are handled they will be accurately identified. A very simple notation of hatching dates and the corresponding toe-punch identifications may be kept in a pocket memorandum book. This is planning

ahead, to furnish information which will be of incalculable value later on when adult layers are being examined, especially with regard to possible usefulness as breeders. The reason lies in the fact that in every lot of chicks there will be individuals, both male and female, which differ considerably as to rate of development to maturity, from those which are "early maturing" to those which are "late maturing." Experience has shown that, other things being equal, the earlier maturing individuals in any hatch are apt to prove to be the best and most economical layers. It is well, then, to be able to distinguish between the pullets of a given hatch on this matter of rate of growth or development. In the fall, as the pullets are being caught up, examined, and distributed to laying flock units it may be that pullets of two different ages may be reaching the same stage of maturity, the one lot being late-maturing birds from an earlier hatch and the other being early-maturing birds from a later hatch. Both look alike at the time, and yet they are inherently quite different. This matter of early maturity is not in itself a factor which will suffice as a means of breeder selection, but when used along with other factors, presented below, is useful and significant.

2. Watch all pullets as they go through the growing season and note which seem to be making most steady and economical development. Good future breeders rarely come from the pullets which did not have good growth records.

3. In late fall when the season's pullet crop is

being caught up and handled and assigned to laying quarters, do two things:

a. Cull closely, discarding all individuals which do not show promise of healthful, strong constitutions and which do not appear to be the sort that will be able to stand up under the management methods which must be used on the modern egg farm. Often times the poultryman weakens and gives weak and undeveloped pullets "a chance." This is unbusinesslike and uneconomical. Cull closely at this time of the year. High mortality rates and large numbers of culls are often explained by this failure to properly cull the pullets in the fall of the year.

b. By use of one's knowledge of the body characteristics which should be possessed by strong, healthy, good type pullets as they reach egg-laying maturity, the pullets should be sorted and grouped carefully as they are assigned to laying houses. The suggestion is that the best quality 25% of the season's pullet crop should be isolated and separately housed, and looked upon and treated as those birds from which future breeders are to be chosen. The characteristics which should be considered in this selection might be

1. tendency to relatively rapid and even maturity, as revealed by toe-punch records of hatching dates. No late-maturing pullets should be put into this "future breeder" group, for egg farmers must breed tendency to early maturity and precociousness into their strains of fowls.

2. good firm flesh, indicating a reserve of fat and strength with which to begin the laying year. The poorer grade pullets are apt to be in thin flesh at this time.

3. good substantial body size for the breed being bred. It requires a bird of good size to stand up under modern management practices and to maintain health. One must be familiar with the body size and weight which should characterize individuals of the chosen breed. The American Standard of Perfection established weight requirements for the several breeds and varieties may well be taken as the guide to go by in this regard.

Fig. 17.—The Fall round-up on a Pacific Coast Leghorn farm where thousands of layers are annually bred and reared.

4. every sign of robust, vigorous health, such as clean, red comb and head parts, alert and active

carriage of body, and absence of abnormalities or symptoms of disease.

5. at least a fair degree of accepted Standard quality, as to form of body, shape, plumage color, and similar bodily characteristics, because uniformity of products from such of these selected fowls as will later become breeders and much of their sales values will be determined by their close adherence to the characteristics which have come to be universally recognized as belonging to and making up that given breed or variety.

6. any facts concerning pedigree or parentage which may be at hand concerning any individual pullet being handled.

7. body symmetry, choice being given to those individuals which are well proportioned and not rough, angular, and ill-proportioned in appearance.

c. Divide the 75% remaining into laying flock units, preferably of not more than 100 individuals each, for best control and more profitable results, and handle these pullets for a maximum, safe egg yield during the ensuing year.

d. House the best 25% above referred to in units of not more than 100 pullets each, preferably 50 to 65, and proceed to feed, manage, and watch these selected pullets for every sign which may indicate special egg production tendencies on the parts of any members of the flock. From these selected pullets should be chosen all breeders in future seasons. If the job of selecting out this best quality 25% of the growing season's pullet crop has been efficiently done, and it can be so done by egg farmers of experience and real interest in their work, it is economical and safe to depend upon this upper quarter to provide sufficient high-grade breeders to meet the needs of the average plant in an average year.

e. On or about December 15th, that is in midwinter, and after the greater part of these selected pullets have been in production for approximately two to two and one-half or three months, go over these birds, carefully handling each one and looking for those body characteristics which are evidence of heavy winter season egg yield. This examination can best be done some evening when the birds are quiet on the perches, and by means of a day-light globe, thus avoiding scaring and upsetting the layers by catching and handling them during day-light hours. There should always be a minimum of frightening or disturbance of laying stock. Among the body characteristics which should be found on good winter layers at this time are

1. loose, thin, soft, easily pliable quality of skin.

2. loss of yellow pigmentation in the eye ring, vent region, beak, and even on shanks.

3. good condition of flesh.

4. brilliant red, soft, pliable, and full-blooded head parts, especially the comb, indicating full and rapidly functioning blood stream.

5. soft, pliable pelvic bones, and well-spread distance between pelvic bones, the pelvic arch.

6. depth of abdominal section of body, indicating good spread between the line between the pelvic

bones and rear end of the keel or breast bone. This indicates space in which the digestive and egg-producing organs have been developed.

Such of these pullets as rank rather high under these six utilitarian characteristics may be marked as being in a condition of economical and efficient egg yield in mid-winter. This means that such fowls probably possess precosity, a valued factor in building up high flock averages in future years. *Place a blue celluloid leg band* on these good and prolific winter season egg producers. If care is used in this handling and careful interpretation of body characteristics has been made at this time, the scheme may approach considerable efficiency as a means of breeder selection. It should be tantamount to isolating the individuals capable of laying 50 or more eggs during the four winter months, October through January (when egg production has been begun approximately October 1st). This blue-banding is a most useful device for use the following fall when final selection of breeders is made. It is the first bit of evidence to look for and use.

f. On or about April 15th, that is in the midst of the spring season of naturally heavy lay, again handle these selected pullet flocks, looking once more for the earmarks of full laying condition. Use very much the same characteristics as were used in the mid-winter examination, but add to them

1. continuation of evidences of bodily strength and vigor, eliminating those showing weakness or

inability to stand up under feeding and management for high egg yields.

2. elimination of individuals which show returning pigmentation, or any other signs of cessation of egg production.

Mark pullets which are in full laying condition in mid-spring with *a white celluloid leg band,* showing high intensity of egg production, another valuable characteristic to be bred into every efficient strain of laying stock. Pullets which have earned both blue and white leg bands are those which will be of greatest interest when it comes time actually to isolate breeders in the next fall.

g. Then, as a last utility handling for the year, again go over these selected pullets on or about August 1 to 15, that is in mid-summer, looking for proof of persistent egg yield, and mark each bird then still in full egg laying condition with *a red celluloid leg band.* Use the same characteristics as in previous handlings, but add that of

1. the molt. Early molters are, as a rule, the poorer layers. The best layers should show no signs of normal molt in mid-summer.

h. In the late fall, when once more the adult poultry flocks are being assigned to laying and breeding pen quarters for the oncoming winter and laying season, this colored banding scheme will arise to be of great help in breeder selection. The pullets which show all three bands may be taken to possess the three great earmarks of economical egg yield that is precocity, intensity, and persistency of production during the first laying year. It is particularly important that future layers should have earned both the blue and the black bands. In a later part of this chapter the significance of winter and summer-fall egg yields, and especially of the "w.s.f." record, that is these two added together, will be pointed out. It will be seen that if an efficient grade of handling and interpretation of external body characteristics has been done at the three seasons mentioned approximately the same sort of breeder selection will have been done as if trapnesting had been accomplished and actual egg yield records had been the basis of the breeder selection. It is a matter of using the correlations between actual known egg production performance records and certain easily discerned body characteristics which have been observed over several years and in many thousands of actual cases, as a basis of this "blue-banding scheme."

i. In the late fall, in addition to a reading of the colored bands which may have been earned by the various pullets, examination of each bird with regard to condition of flesh, apparent health and bodily strength and vigor, and Standard quality must be made. It is a serious and most important matter for the egg farmer to take every precaution possible to eliminate poor types of hens from his future breeding flocks and to include in them the sorts of birds which he knows will give at least fair promise of producing a profitable number of table eggs.

This scheme of breeder selection without trapnesting cannot be as accurate or exact as one which does employ trapnesting, but it will aid hundreds of egg farmers who do not feel like undertaking the job of trapnesting and pedigree breeding. It will be efficient in measure as the farmer is capable of reading and interpreting external body characteristics in terms of probable egg yields. Education and experience will enable many egg farmers to become proficient in this regard.

2. *On the Egg Farm where Limited Trapnesting is Possible.*—This author has been investigating this particular phase of practical poultry breeding for several years, because he has found many egg farmers who were sold to the idea of identification of individual layers as to their inherited egg production capacities, but who did not find themselves in an economical position which permitted of full-year trapnesting. It is sometimes a matter of actual cost, and at other times a matter of time, particularly during the spring season when incubators are in operation and the chick flocks are demanding every spare moment available. It has become a question of business management. Poultry breeders must be chosen, and upon a sound basis of inherent capacities. Have the many years of trapnesting and careful recording of egg production performance revealed any traits or bodily characteristics which may now be used safely and reliably as criteria of breeder selection? Or have egg yield records for any short-time periods of the year been found to be sufficiently closely tied up with high annual egg

yields to become useful as bases for breeder selection? It is obvious that if the poultry breeder can efficiently depend upon short-time egg yield records as means through which to choose future breeders and thus reduce the time and cost of breeder identification for the plant, the overhead cost of layer replacement will be materially decreased.

In their bulletin published in the fall of 1936, Thompson and Jeffrey, at the New Jersey Agricultural Experiment Station, have presented figures which may serve as a basis for building up a workable and economical scheme of breeder identification by means of short-time trapnesting. Their studies included 2,028 S. C. White Leghorn pullet egg production records, a sufficiently large number to merit attention and invite confidence. Three short-time trapnest records were used.

1. The "W" record, or the egg yield of the first four months, or for the winter season, that is for the months of October through January. It is feasible and practicable for poultrymen to plan to trapnest pullets for these four winter months and then stop trapnesting, using the records of those four months of egg yield as criteria of breeder selection. It was found that the correlation between the number of eggs which the pullet would lay during these four winter months and the number she would produce over the entire first laying year was definitely and significantly positive, being .7075 ±.0076, which, to the poultryman, means that there was a definite tie-up between these two egg production records, and that

the poultryman might use the actual egg yield of the winter season as a basis of predicting what might reasonably be expected of the pullets over the entire first year of laying. It was found to be at least 30% better than pure guess, and that is worth while. In 100 trial cases chosen at random, it was demonstrated that when first year egg yield was predicted upon the basis of known winter egg production (using the formula, $Y = 136.24$ logarithm $X - 30.79$, wherein Y stands for the first year egg yield being predicted and X stands for the known winter egg production), 55% of the predicted annual records were within 30 eggs of the actual facts of the cases. This all suggests that if the egg farmer does find himself in an economic position in which it is not advantageous for him to trapnest his pullets beyond that first winter season, he may rely upon that winter record reasonably safely, and at any rate be considerably better off than as if no actual trapnesting had been done.

This author would go farther and suggest that such winter record might even be a somewhat better measurement of the pullet's inherited egg production capabilities than is the full year record because the winter record is taken while the birds are still in the finest physical condition possible, while they are producing largely in response to inheritance, while they are uniformly under favorable environmental conditions, the winter laying house, and while varying management and surrounding factors have had less chance to influence egg yield than will be true over the entire year.

If this scheme appeals to egg farmers who are planning on producing their own replacement laying stock, it is suggested that the same best quality 25% of the season's pullets be segregated and separately housed in the fall as they reach laying maturity, as was recommended when no trapnesting is to be done. Then, place these selected pullets under trapnest for the four winter months, according to the following plan:

1. Trapnest and individually record egg yields of these pullets during October through January, the winter season.

2. During the fourth month, or January, weigh all eggs produced and individually record all egg weights, in order to know what egg-size quality each pullet is inherently capable of yielding. Work at the New Jersey Station and elsewhere has demonstrated that average pullets will show approximately the same proportion of various egg sizes during their fourth month of egg production as will obtain for the entire first laying year, and thus knowing what egg size has been produced during January serves as a sufficient guide concerning egg-size quality. Remove the identifying leg bands from all pullets which do not show *at least 60% of eggs weighing at least 24 ounces to the dozen during January.*

3. At the close of January add up the records, and remove bands from pullets which did not show *at least 50 eggs during the winter season.* Other things

being equal, future breeders should then be chosen from those pullets which do retain their bands after this first winter's trapnesting.

4. Such winter-trapnested pullets may conveniently be divided into three flocks:

a. those which produced between 50 and 69 eggs inclusive.

b. those which produced between 70 and 84 eggs inclusive.

c. those which produced 85 or more eggs during the winter season.

The a. group should be looked upon as good layers and well worth using as breeders, other things being equal, of course. The b. group should be considered as extra good layers and worthy of mating with the best of pedigreed sires. The c. group should be treated as those which have probably the richest inheritance as egg producers and will probably be used for the best matings and breeding-sire production.

2. The "S.F." record, or the egg yield of the last four months of the laying year, the months of June to September inclusive, was found to be even a better guide as to inherited egg production tendencies, for in this case the correlation with annual egg total was +.8017 ±.0050, furnishing a basis for prediction which might prove to be approximately 40% better than pure guess, an improvement of about 10% over that of the winter egg yield record, it will be seen.

Trial has shown that it is not impractical to allow pullets to lay their eggs in open nests for the first few months of the first year and then to place them under trapnest conditions for the latter weeks or months of the year, as would be necessary if the summer-fall (S.F.) record alone were to be used as short-time period for trapnesting. In this case the prediction formula used was $Y = 133.22$ logarithm $X - 31.62$, in which Y stood for annual production and X for the summer-fall egg yield. In the 100 trial cases 59% came within 30 eggs of the actual egg yield for the year. This proved to be about equal in selective usefulness to the winter season record.

An interesting feature of these studies revealed that there was no relationship whatever between the number of winter eggs which a pullet would produce and the number of summer-fall eggs which she might lay. Apparently both tendencies were inherited as separate characteristics and must be selected for individually. It is not possible to estimate the summer-fall egg yield of which a pullet will be capable by knowing what she did lay during her first winter season.

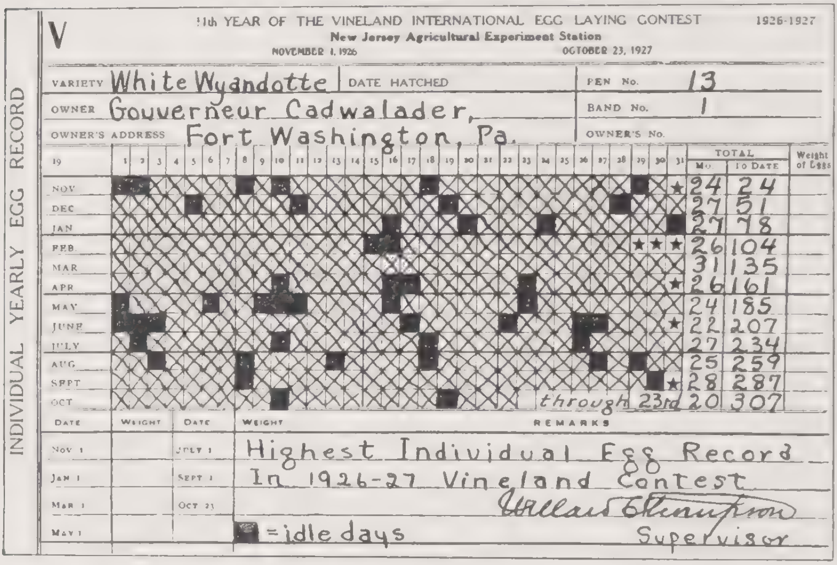
3. This study revealed a third short-time egg record which appears to have a much greater value than either the "W" or the "S.F." records used separately, and that is what the authors have called the "W.S.F.," or winter-summer-fall, egg yield record. It has been secured by adding together the actual egg yields for the winter season and the summer-fall season. When this was done the correlation between the short-time record and the annual egg production

total soared to +.9368 ±.0018, which furnishes a basis for prediction which would probably be something like 65% better than pure guess, and this is well worth considering. In the test of this method it was found that 84% of the predicted annual egg totals were within 30 eggs of the actual productions. The use of this "W.S.F." record, therefore, might become a means of great efficiency in the matter of breeder selection. Any fowl showing *at least 100 W.S.F.* eggs would be worthy of selection for breeding purposes. Especially would this be true since above it has been intimated that the minimum winter yield to warrant selection and the minimum summer-fall record must be 50 eggs. This would mean that such pullets as showed 100 or more W.S.F. eggs would undoubtedly have inherited both precocious and persistent egg production tendencies.

The egg farmer, who is also, to some extent at least, a poultry breeder, has to choose between these three alternatives as to short time trapnesting seasons to be employed. It is obvious that the most efficient method, from the standpoint of breeder identification, must be the "W.S.F." season scheme, with the "S.F." second, and the "W" scheme alone third. From a commercial, or cost, viewpoint, however, it may well be that the "W" scheme, that is using the winter season trapnesting alone, will be the method chosen as being most practical and least costly to operate. It will do a reasonably efficient job of differentiation.

The remainder of the flock improvement program for use on the plant where only part-time trapnesting is being done might be:

1. The handling of all pullets retaining bands at the end of the first laying year, with regard to health, vigor, condition of flesh, Standard quality, body size



INDIVIDUAL YEARLY EGG RECORD

V

11th YEAR OF THE VINELAND INTERNATIONAL EGG LAYING CONTEST 1926-1927
New Jersey Agricultural Experiment Station
NOVEMBER 1, 1926 OCTOBER 23, 1927

VARIETY White Wyandotte
DATE HATCHED
PEN No. 13
OWNER Gouverneur Cadwalader,
BAND No. 1
OWNER'S ADDRESS Fort Washington, Pa.
OWNER'S No.

19	TOTAL Mo.	TOTAL To Date	Weight of Eggs
NOV	24	24	
DEC	27	51	
JAN	27	78	
FEB.	26	104	
MAR	31	135	
APR	26	161	
MAY	24	185	
JUNE	22	207	
JULY	27	234	
AUG	25	259	
SEPT	28	287	
OCT	20	307	

through 23rd

DATE	WEIGHT	DATE	WEIGHT
Nov 1		July 1	
Jan 1		Sept 1	
Mar 1		Oct 23	
May 1			

REMARKS

Highest Individual Egg Record
In 1926-27 Vineland Contest

Supervisor

■ = idle days

Fig. 18.—This trapnest record of a typical well-bred White Wyandotte pullet was made at one of the New Jersey egg laying contests a few years ago. It exemplifies high "W" egg yield, high "S.F." yield, and also very meaningful "W.S.F." egg production performance.

and type, and such other characteristics as may be desired to be included in the strain development.

2. The mating of these breeder hens to well-chosen pedigreed poultry sires.

3. The weighing of all hatching eggs eventually gathered from such selected hens and the elimination of *all eggs* not *weighing at least 26 ounces to the*

dozen from incubation purposes. This is a use of the "26 ounce" rule, as Thompson, in New Jersey publications, has called it. This same rule might also be used in connection with the "blue-banding" scheme above presented, whenever it is desired to bring about real strain improvement with regard to egg-size. The details of this "26 ounce" rule are as follows:

a. Weigh each egg gathered from breeder hens.

b. If the egg weighs at the rate of 26, 27, or 28 ounces to the dozen, mark it with a figure "6." Otherwise do not mark the egg. Preferably, for quick attainment of real flock improvement in egg-size or weight, discard all eggs except the "6" eggs for hatching. This will mean that all chicks hatched will have come from those size-selected eggs, and that the resultant pullets will tend very markedly to produce an increased number of large size eggs, which will command top market prices, or even premiums because of size. It will be noted that extreme egg size is not advocated.

c. If this discarding of all other than "6" eggs is too drastic for immediate use on a given egg farm, it may be tempered and the principle still used, by hatching the "6" eggs separately even though unmarked eggs gathered from the selected breeders may have been set. The chicks hatching from "6" eggs should be toe-punched at hatching time and marked with an identifying mark, such as *the outside right toe-punch*, which mark should be reserved to always mean just that identification and nothing else.

The author has seen hundreds of egg farm flocks quickly and startlingly improved in the matter of egg weight or size by the rigid application of this "26 ounce" or "6" rule, as it is variously called. It may be used quite independently of trapnesting, it will be noted.

3. *On the Egg Farm where Trapnesting is Considered Economically Worth While.*—There are many egg farms where the basis of breeder selection will continue to be the "actual egg production performance records of the first laying year." This involves the actual trapnesting and recording of pullets throughout the year, including all seasons. In light of what has already been said in the above paragraphs, the scheme for full year trapnesting may be briefly outlined as follows:

a. Again select the best quality 25% of the season's pullets and separately house them where they may be trapnested and carefully watched throughout the year.

b. At the end of the first year, apply the following minimum standards of egg yield, as a basis of breeder identification. These are based upon observation of many thousands of actual trapnest records for the first laying year:

1. A minimum of 50 winter season eggs; also a minimum of 50 summer-fall season eggs.

2. A minimum of 200 eggs for the entire year.

3. A minimum of 60% of 24-ounce-to-the-dozen

size eggs during the month of January. It is not necessary to weigh eggs throughout the year.

4. An absence of broodiness tendency.

5. An absence of winter-pause.

6. An average clutch-size of at least four eggs during the winter season.

7. Desired health, flesh, size, and Standard type and quality.

8. Use of the "6" rule for all hatching eggs gathered from these full-year-record hens.

c. The egg farmer may wish to enter some of his pullets in Egg Laying Contests, as a means of advertising, keeping before the public, or for other reasons. Select the best pullets reared during the season and enter two flocks in Egg Laying Contests where pullets are being trapnested.

d. At the close of each Egg Laying Contest year, use the pullets which have shown at least 200 eggs for that first year as breeder hens, either entering them in some Hen Contest, such as the Vineland, N.J. Hen Contest, the first venture of its kind in the world, or use in special breeding flocks at home. From such officially trapnested hens should be grown pedigreed cockerels for use in strain development.

e. Many egg farmers may wish to avail themselves of the semi-official trapnesting schemes which are available in the several States and now being standardized under the National Uniform Plan of Poultry Flock Improvement, under the supervision of the U.S. Department of Agriculture and administered separately in the various states. These are the so-called R.O.P. breeding projects, in which the trap-nesting and recording is done on the home farm by the owner or his representative, but under the superintendence of some public official.

f. Under this line-breeding scheme for flock improvement the introduction of new blood, that is new stock, from time to time may be desirable. It should be done only through the purchase of hatching eggs or day-old chicks, and not through the transfer of adult stock, except under most rigid inspection and sanitary precautionary measures.

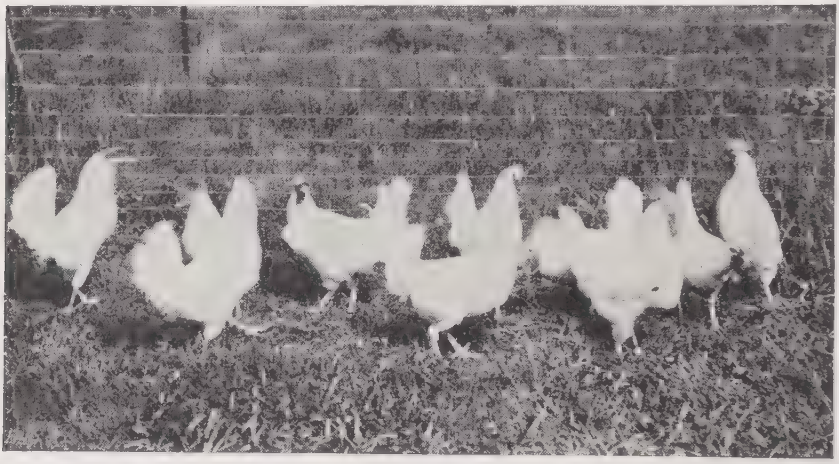


Fig. 19.—A typical egg laying contest flock. 10 S. C. White Leghorn pullets, at the Vineland, N. J. 1933-34 egg laying contest, bred and entered by D. H. Mahar, Kwality Poultry Farm, Cranbury, N. J., which laid 2,467 eggs, scoring 2,546.1 points, winning that contest.

The Devices Needed by the Poultry Breeder.— In the foregoing paragraphs an attempt has been made to present a workable, practicable and economical scheme for efficient replacement of layer stock on the egg farm, recognizing of course, that in many instances the production of a surplus of hatching eggs, day-old chicks, young pullets, or ready-to-lay stock may take place and therefore become additional sources of revenue to the egg farm. No attempt has been made to present a review of all possible methods, but simply to give the rules for the methods which this author recommends after more than twenty years of close observation and contact

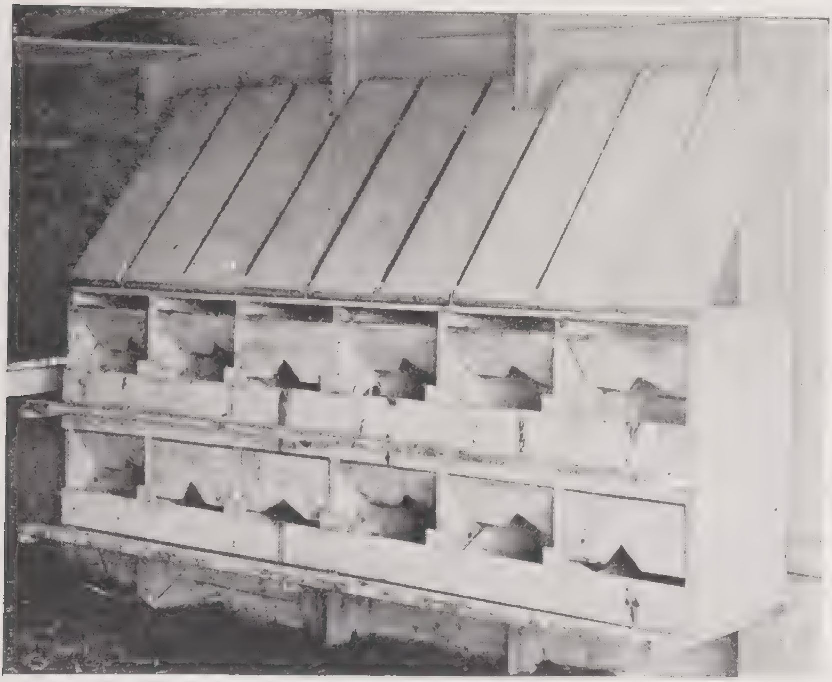
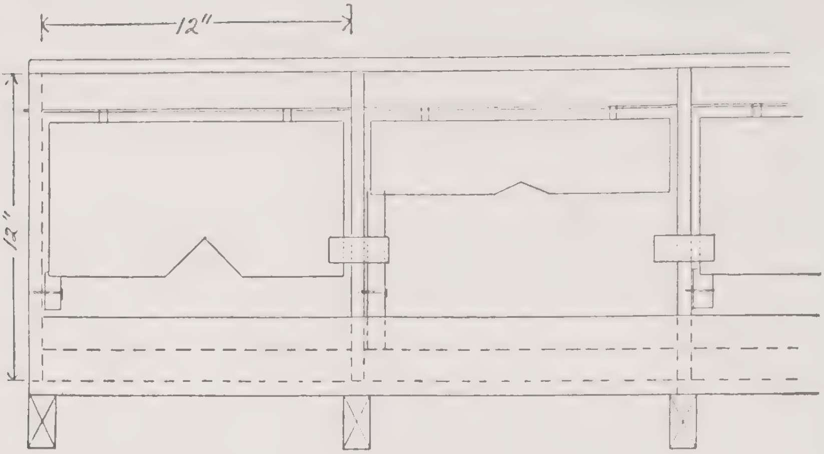
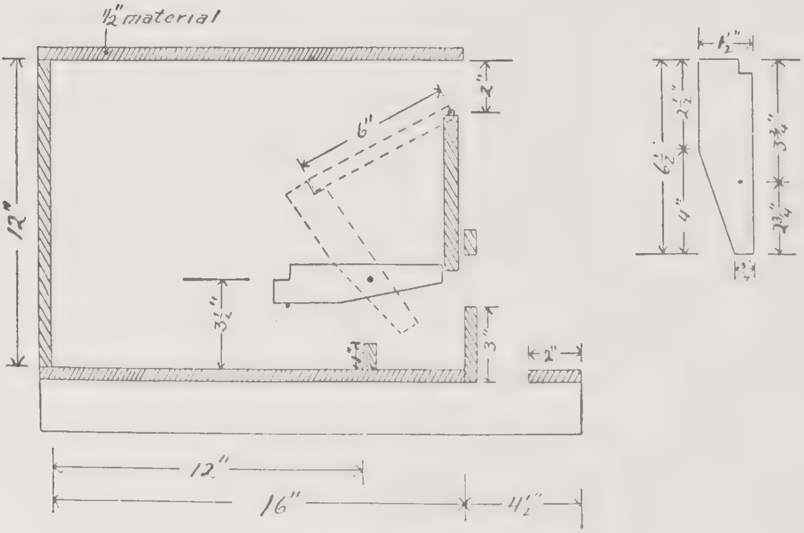


Fig. 20.—The revised Connecticut trapnest, as in use in New Jersey poultry industry as a means of securing accurate egg yield records.



Front View



Cross Section

Fig. 21.—Working plans for the revised Connecticut trapnest.

with the industry of poultry and egg production. It is assumed that the readers of these pages are seeking for working rules and ideas.

Now, then, in order to put these suggestions into practice some equipment is needed and some few management directions are necessary:

1. Preferably divide pullet flocks which are to be trapnested into units of not to exceed 100 individuals each. Fifty bird flocks for trapnesting and general careful, intensive management will give still better results.

2. Procure some good, efficient type of trapnest, of which there are many satisfactory types offered by Experiment Station officials and by commercial equipment companies. The author has liked the Revised Connecticut Trapnest which has been in use at the N. J. Agr. Exp. Station and the New Jersey Egg Laying Contests for many years.

3. Attend the trapnests frequently, at least six times per day, making sure that layers are released as soon as possible after they have laid.

4. Use a simple, but adequate daily individual egg production record, on which there is ample space for a clear and unmistakable recording of the fact of egg production.

5. The full-year trapnest will reveal the following facts concerning the egg production tendency of each individual hen in the flock, and each of these items should definitely be looked for and ascertained before final selection of future breeders is made: (a) Total number of eggs laid during the winter season —October through January. (b) Date egg production started—early beginners are the best birds. (c) Winter pause—no cessation of egg production should

occur during winter days—seven or more days without egg yield is usually considered to be a definite, inherited winter pause, (d) Weight of eggs laid during the fourth month, that is in January—60% or more of first-grade size eggs being desired, (e) Tendency to broodiness during winter or spring seasons —broodiness is an inherited characteristic and can be bred out of a strain by selection of breeders which do not show broodiness tendency, (f) Intensive spring season egg yield, (g) Cycle and rhythm of egg production throughout the year—cycle constitutes the number of eggs laid on consecutive days, and long cycles of egg yield are essential if high egg production totals for the year are to be secured—rhythm is made up of the tendency to repeat cycles—short, oft-repeated cycles are less desirable than long, less often-repeated cycles, (h) Summer-Fall egg yield, as a measure of persistent egg yield tendency, (i) Total egg yield for the first, or pullet year, (j) molt—early molters are usually less valuable as persistent layers and late molters, that is during September and October or even November, are usually found to be the heavier producers over the year period. With information on these ten important points at hand a careful and reasonably accurate job of breeder selection may be done at the close of the pullet year.

The Setting Up of Suitable Matings and Breeding Flocks.—No pullet selection program is worth while unless it is followed by a scheme of use of the selected individuals as breeding stock which will employ the information gleaned in that process or trapnesting or pullet-handling. There is not time, space, or necessity in this place to discuss all possible methods of mating and flock breeding which the egg farmer might use, but rather is it desirable here to indicate a workable, practical scheme which will get results.

1. *Single Male Matings.*—The quickness with which real flock improvement may be made to take place is one important element in keeping the costs of modern egg farm management down to reasonable figures and figures which may permit of profits. Like many other things in the present day, speed of securing results pays. The quickest way to secure increased egg yields from oncoming pullet layers is to produce them from "single male matings," as they will be called in this book, that is small flocks of selected hens mated with one male bird. This, at once, limits the number of hens which may safely be mated with a chosen poultry sire to approximately ten to fifteen, with an average of a dozen, or twelve, hens being usually an optimum size of flock to mate with one male bird during the breeding season. By means of this scheme the male parentage of each chick can definitely be known, and by trapnesting of the hens through their breeding season the female parentage may be known. This involves, of course, the use of pedigree-hatching, that is the hatching of each marked egg in a separate bag or wire tray, in order that its identity may not be lost. However, for the average egg farmer, it is probable that the most essential thing will be to identify the chicks

which come from each flock. In the making up of the hen population of each flock effort should be made, whether the mode of selection has been by the "blue-band" system or through trapnesting, to place individuals of approximately the same egg producing quality together, in which case it will matter little whether or not the poultryman maintains the identity of the female parentage. It is suggested that costs will be cut considerably if the principle of "flock pedigreeing" is adopted as a general method for layer improvement on average egg farms. The male bird chosen to head each such flock should be most carefully selected, as he will influence and effect the quality of every chick produced from that flock. Truly "the male is half the flock." Reference is made below to a practical method of male bird selection.

In matings of this type much information may be secured which will contribute directly to the general improvement of the strain of fowls being carried and which would not be available except that only one male bird has been used with each unit flock of breeding hens. If only a few of the eggs are fertile, or if hatchability continues to be unsatisfactory, a change of male birds is probably in order. The results of the first two or three hatches may indicate a great deal about the worthwhileness of the original mating set-up.

Such "single male matings" do, obviously, require the setting aside of a number of small pens, perhaps approximating 8′ x 8′ in size, providing about 64 sq.

ft. of floor space, for the accommodation of the single male and his flock of hens. This disadvantage is offset by the quick returns usually made through using such segregated matings. These flocks, on the average place, should be selected and set up prior to the Christmas holidays, and the male birds placed with the hens not later than about mid-December, in order to insure fertile eggs early in January. If care and expense have been spent in the selection of both male and female individuals to be used in the breeding operations for the season, it is economically necessary to make such use of those selected breeders as will earn the fullest possible returns to the farm on that expenditure. It is a mistake to use carefully selected breeders only through a relatively short breeding season, for thence only a comparatively small number of new layers can be secured from that selected parent stock. It is suggested that ordinarily an attempt should be made to save all hatching eggs from special matings from January 1st through April, and, even though it does increase the number of hatches and broods to be handled, thus secure a considerably increased number of pullets from such "better" stock. Mark the eggs from each "single male mating" with the flock number, and incubate and hatch those eggs separately, marking the chicks with an identifying toe-punch. This simple and useful method of handling selected breeders for the average egg farmer who is primarily interested in producing his own replacement laying stock each season and who wants to show some steady improvement in egg production quality each year can easily prove to be not only economical and efficient, but quite adequate as well.

Preferably use a pedigreed, carefully selected male bird as the head of each such single mating. A "proved sire" is better yet. At least two or three such special matings might well be set up on each egg farm, even though the bulk of the pullet crop may be produced from mass matings. In such special matings use the very best individuals, both male and female, afforded on the place. Primarily aim to produce future breeding males from such special matings, as well as improved layers.

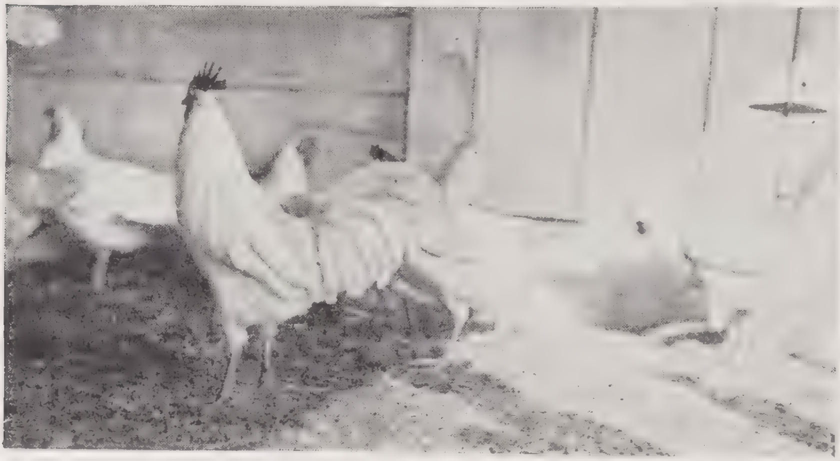


Fig. 22.—A typical "single male mating," including a pedigreed sire, of proved breeding quality and trapnested and carefully selected hens.

After one breeding season has established a good record, as to fertility, hatchability, and liveability of chicks, for a given special mating, attempt to keep over the individuals, specially the male bird, for use in at least one more season. Proved breeders are worth many times the value of untried breeders.

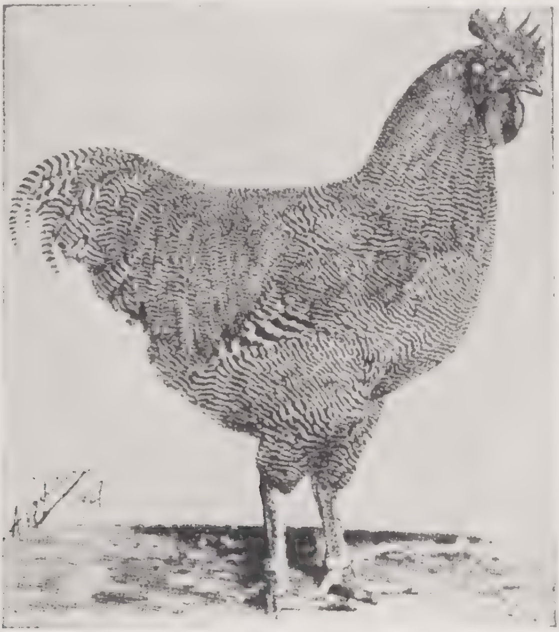


Fig. 23.—The Barred Plymouth Rock has long been recognized as one of the best American breeds of poultry for use as a general or dual-purpose fowl. This famous male is typical of the Plymouth Rock type and shape. (*Courtesy of Bradley Bros.*)

Too frequent changing of poultry breeding males, that is the constant annual employment of cockerels as heads of breeding flocks, has held back much flock improvement which might otherwise have been created.

Whenever "single male mating" schemes are being used, it would be wise to plan for and provide a double number of breeding males, for so often something happens to a chosen male during the season and it becomes necessary to substitute another. Sometimes early season results indicate that another male bird must be used. It should be at hand.

2. *Mass Flock Matings.*—By this term is meant any poultry flock mating in which there are two or more male birds being used, so that the identity of the male parentage becomes lost. These mass flock matings may vary, of course, from the two-male flock with its twenty to twenty-five hens up to the flock of a hundred or more with its dozen of males. It is rarely advisable to set up a mass breeding flock exceeding one hundred hens in size, and therefore requiring approximately ten or twelve male birds. The selection of both hens and breeding sires for such larger, or mass flocks, should be just as carefully and painstakingly done as if the individuals had been divided up into "single male matings." On the egg farm of some size and especially where no specialty is made of producing pedigreed stock for sale, the use of these larger unit mass matings is quite advisable, from a business point of view.

In the making up of "mass flock matings" quicker results can be assured by the use of line-bred, closely related male birds, even brothers, if possible. If mass matings are carefully made up the resultant pullet layers should be approximately of the same general quality as if the smaller breeding units had been employed. It will all depend, of course, upon the standard of quality which has been maintained in the selection of the breeders used.

In these larger flock matings it is possible to insure better fertility, hatchability, and liveability of chicks through the proper management of the breeding males. A workable practice is to use one set of males with the flock for about three or four days, after which they are removed and another set are placed with the hens, while the first set are rested, fed well, and kept in good physical shape. This scheme of "rested males" is sound. It does require having twice the number of male birds originally required by the given number of hens, but on the

Fig. 24.—A mass flock mating made at the National Institute of Poultry Husbandry, England, in 1925 by the author, and in which ten own brothers from high egg yield parentage were used.

average egg farm this is not an insurmountable difficulty, nor an economic obstacle.

"Mass flock matings" are provided to supply the greater bulk of the season's chicks on the average plant, and will come into greatest usefulness during the midst of the season.

Special Points in Selecting Poultry Breeders.—Over and above the usual characteristics which are looked for in the selection of suitable poultry breeding stock, and which have been described above, there are a few points which deserve special mention because of their particularly important bearing on the economy of the egg farm as a business enterprise:

1. *Proved Poultry Sires Best.*—There are three principal things which should form the basis of inquiry in the selection of poultry breeding sires for use in real flock egg production and liveability improvement.

a. *Pedigree, or Family Tree.*—Every fowl has a family tree, a pedigree, a set of ancestors from which it has been produced. Because of the greater influence which the poultry sire has on the oncoming layer flocks than can any one female in the breeding flock exert, the pedigree of the male bird takes on a special economic significance. To know the egg production tendencies of the fowls which have been a part of a male's pedigree or family tree is nothing more than securing facts upon which to base one's gamble upon the egg production tendencies which will be passed on to that male's progeny. Pedigree guarantees little, but it does form a basis for judgment. It is important, as a guide. It often indicates what use may best be made of a given male bird. It should never be over-estimated as to value.

b. *Individuality.*—Every poultry breeding sire should himself be at least a fair representative of the type and breed of bird which it is desired to reproduce. The breeding male must possess qualities similar to those which he is called upon to reproduce in his chicks.

c. *Progeny Test.*—The third, and in some respects the most significant, factor which proves a poultry breeding male is the progeny test. What sort of quality and egg production capacity will be exhibited by the sons and daughters which he sires? In a scheme wherein cockerels are used each year, little or no chance for getting facts as to progeny performance is afforded. If only "mass flock matings" are employed, again there is rare chance for progeny testing, an argument in favor of the "single male mating" system of breeder assignment. The author believes in the fundamental soundness of the "single male mating" for most real flock improvement work.

What practical facts should be gleaned in order to have some feasible measure of progeny production performance?

1. In the fall following the use of a given male as a poultry sire the resultant daughters or pullets come into egg-laying maturity. Their behavior as egg producers during their first winter season can be noted and studied before it is necessary to decide

as to the fate of their sires in the approaching breeding season. In other words, the fall and winter egg yield of pullets may be used as a criterion of their inherited egg production tendencies, and as such be used as one element in the progeny test.

2. During the growing season the rate of growth, sturdiness and vigorous health, continuousness of steady, normal development, and capacity to make efficient use of feed given can be observed and used as another element in the progeny test.

3. The percentage of hatchability and liveability of the spring's chick flocks from the given matings is another item in the testing of the male birds as efficient sires.

The adoption of the principle of using proved poultry sires cannot be made at once and completely on many plants, but it may be the ultimate practice through proper planning over a few years' time. It is sound in its basic arguments.

Proved sires for use in "mass flock matings" are just as essential as they are in "single male matings." It is a false idea to suppose that just because several male birds are used in mass flock matings that some lesser degree of quality may be condoned in those male birds.

2. *Select Breeding Hens for Longevity.*—One of the best egg farms in northern New Jersey annually makes it a practice to use as breeder hens only individuals which have been trapnested and watched for at least two years and which have proved themselves economical and efficient egg producers over that pe-

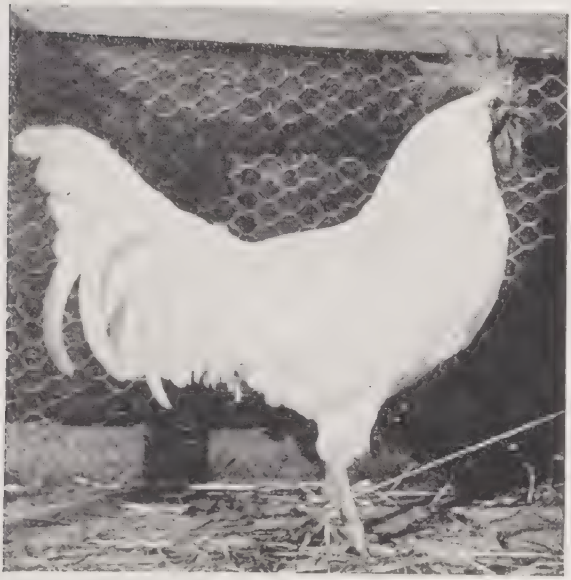


Fig. 25.—A remarkable poultry breeding sire, bred and owned by Mr. Beall, Vashon, Washington. His dam laid 330 eggs in her pullet year. His paternal granddam laid 311 eggs in her pullet year. The cock bird here shown possessed individuality as well as a valuable pedigree. Later his progeny test proved him as a sire.

riod. This farm makes up its breeding flocks of "old hens," that is breeding females which are often three, four, and five, or even more, years old, birds which possess longevity, or capacity to remain active, vigorous, healthy, and productive over a series of years, and which do not wear out after one or two seasons of egg yield. Any hen which has shown at least 200 eggs as a pullet layer and at least 150 eggs as a yearling, other things being equal, merits consideration as a breeder from this standpoint of long-life tendency. Breeding for this longevity is one means of materially reducing the numbers of replacement fowls needed each season, and, in the long run, will reduce the per-bird cost of operations as an egg farm.

3. *Concentration on Special Characteristics Related to Egg Production Capacity.*—The matter of poultry breeding improvement is so complicated that the egg farmer, in business for the primary purpose of producing marketable table eggs at a profit, must limit his explorations in the field of breeding to those characteristics which are known to have some direct bearing upon egg production capacity. These characteristics have been dwelt upon in the pages above. The point here is that the egg farmer who is producing his own pullets must select those bodily characteristics which to him seem most important as relating to egg yield capacity and then select both male and female stock toward such ends. Concentrate, rather than try to improve the strain in all ways and as to all characteristics. It is large enough a task, at best. Make the strain being worked with particularly strong and effective as to those chosen traits. That is the basis of strain differentiation. That is what has set certain nationally known strains of layers apart from the average run of poultry flocks in recent years. In measure every poultry and egg farmer breeding his own stock year after year may do the same thing.

How to Pedigree-Hatch Chicks From Special Matings.—The practical problems associated with operating a breeding improvement program on an egg farm are not difficult, but they need attention:

1. Individually mark pedigreed eggs. This applies to those which are "individually pedigreed," that is which are produced from "single male matings," and likewise to "flock pedigree" eggs, except that in the latter case, of course, only the flock number is placed on the egg. Use an ordinary black pencil, not an indelible, or a colored pencil for egg marking.

2. Treat these eggs in ordinary fashion during the first 18 days of the incubation period. At that time separate them, and place eggs from the same hen, or pen, as the case may be, by themselves. Put

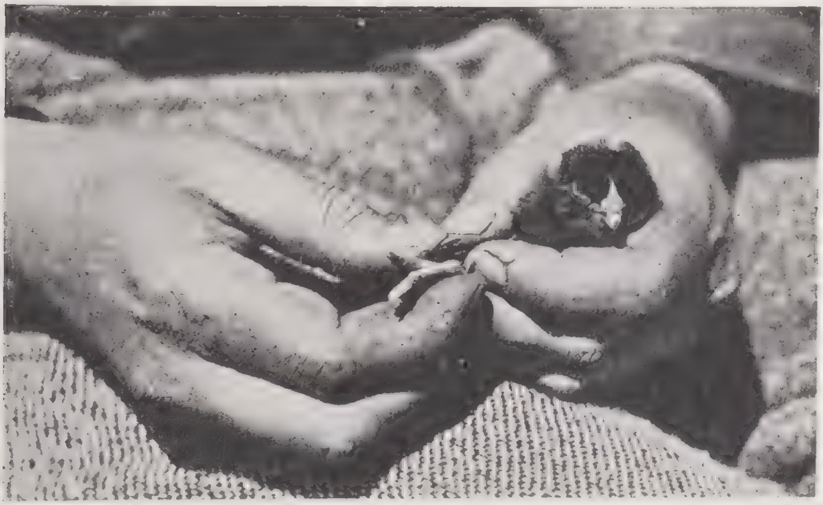


Fig. 26.—The placing of an aluminum leg band on this day-old chick is one means of identifying that individual as to parentage and ancestry.

the eggs of like source in pedigree hatching baskets, or pedigree hatching muslin bags, and return to the incubator trays. Do this work with care and speed, returning the eggs before they can have become chilled.

3. As soon as the chicks have hatched and dried off, open the baskets or bags (not more than four eggs should be hatched in the same basket or bag, as a rule) , one at a time, and band the chicks with some sort of identifying bands, or use toe-punches, if flock pedigreeing only is being done. Record the identifications, whether they are in the form of leg bands, wing bands, or toe-marks.

4. There are several methods of identifying pedigreed chicks. The author prefers the wing band for individual pedigreeing, because of fewer losses and more convenient use later on. He likes to work out a system of toe-marks for "mass flock mating" chicks. For example, mark the Flock A chicks with an inside right toe-mark, and that will identify chicks from that flock mating forever. This author likes to slit the web between the toes instead of using a punch. It is less likely to grow together and thus destroy the identifying mark.

The average egg farmer need not do a great deal of individual pedigreeing, but should employ flock pedigreeing scrupulously, as a means of flock improvement. Individually pedigreed cockerel chicks are needed from which to select improved poultry breeding sires in future seasons.

This chapter has been lengthy, because the factor of breeding is of paramount importance on the modern egg farm. It is again emphasized that it is not particularly material whether the egg farmer does that flock and breeding improvement himself and produces his own chicks and resultant layers or buys his stock from a poultry breeder who carries on such a program. The important thing is for every egg farmer to be sure that he is getting layer stock which is the result of careful breeder or parent stock selection. If it is conducive to lower production costs and the facilities are at hand, it is obvious that the egg farmer himself may well be the one who is conducting the breeding program and producing the young stock each year, enough for his own needs and some for sale, perhaps. This double possibility of some egg farmers producing their own and others buying their stock, as hatching eggs, chicks, or ready-to-lay pullets or in some other form, makes possible the development of various types of poultry industry for an increased number of people. It is probably well, from the economic viewpoint, that every egg farmer does not solve this matter of obtaining good, serviceable laying stock by the same methods and practices.

There is no one factor which will exert greater and more immediate influence upon egg yields and flock averages than this factor of breeding. Egg production, in the opinion of this author, is primarily dependent upon inheritance, although environment and management play their respective parts, of course.

IV

MAINTAINING THE HEALTH AND PRODUCTIVITY OF WELL-BRED LAYING STOCK

WHILE experienced egg farmers readily agree that the capacity of a hen to produce eggs is primarily a matter of inheritance and that improvement of laying flocks is, likewise, essentially a matter of breeding, they also find that, tied up very closely with that factor, there is the all-important proposition of health. Health, in fowls being kept for commercial purposes, may be considered as being that state and condition of fowls which permits them to live and function naturally and normally and to show responses to those characteristics which are a part of their inherited tendencies. In other words, hens are healthy when they display perfectly natural and normal behavior and are quite normal in appearance and activity. To the extent to which hens are not normal in appearance or actions or are not natural in their activities or productive functions they may be said to be diseased. It is apparent, therefore, that there are many degrees of ill health in fowls. This point is significant to the poultryman because it is usually true that the function or activity of egg production very quickly becomes affected whenever even slight degrees of abnormality or ill health appear. It is also true that in fowls many of the earlier symptoms of finally fatal ailments often appear to be trivial in the beginning, but even in those stages egg yields are lowered. Altogether, experience indicates that, in order to win economical production, every possible, practicable exertion must be made to produce fowls with strong, healthy bodies as a part of their inherited endowment, and then to so manage and maintain those fowls as to preserve such native strength and vigor and health.

Vigorous Health Should Be Natural Endowment of Every Hen.—It is just good common sense to figure that whatever qualities bearing upon fowls' egg production capacities may be secured through good breeding and selection methods are, comparatively, economically secured factors which will tend to make profitable egg yields. Factors which are the result of wise breeding and selection do not entail further costs through management and provision of environmental conditions suitable to promote or induce egg yield. The things accomplished by good breeding plans do not have to be done by management after the fowls become parts of the laying flocks. This means, in brief, that the egg farmer, as a poultry breeder, must bend every effort toward producing fowls which have a natural, inherited endowment of strong, vigorous health.

Selection of poultry breeding stock, and breeding, for health and constitutional strength and vigor is not wholly understood, for research and experience have not yet clearly defined these terms, at least in so far as definitely describing just what characteristics are included in them may be concerned. But, egg farmers, it is here suggested, may go a long step forward in this matter of increasing the health of their flocks, or decreasing their losses due to mortality, whichever viewpoint one may choose to take, by employing such items as have been ascertained and which bear upon this problem.

Selecting Breeders for Vigor and Health.—In the fall of the year when the greater number of breeding flocks are being made up for use during the following hatching season, this matter of vigor and health should receive definite and most careful consideration along with whatever other characteristics or qualifications, such as egg production capacity, standard quality, size, etc., are being looked for. But, just this important suggestion! In going over the fowls which are available as prospective breeders, *give attention to this matter of vigor and health first.* Unless a fowl has come through the first or any laying season in a condition of good flesh and apparent health it should not be considered for inclusion in any breeding flock, regardless of any egg yield or quality history which it may have to its credit. A practical method of selecting breeders, as to this factor, might include:

1. Handle each individual, male and female, which it is possible might be chosen as a future breeder, looking for the ear-marks of inherited

strength and the signs of natural, normal conditions having been maintained through recent months of management for egg yields. It is important that the careful breeder, in selecting fowls for his breeding pens, actually handle each individual and not be content with appearances as judged on the floor.

2. Healthy fowls, of adult development such as would be used for breeding purposes, should show such bodily characteristics as:

a. A good condition of flesh, especially on the breast. Weaker, less vigorous, fowls usually exhibit

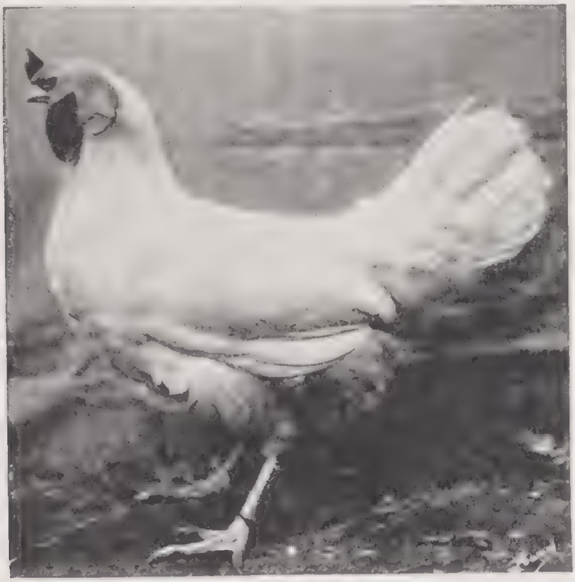


Fig. 27.—This White Leghorn pullet, after a first year egg yield of more than 300 eggs, was found, on handling in the Fall season, to be in good flesh, strong, vigorous, and in apparent robust health.

such tendency toward the end of their first laying year by becoming thin in flesh, somewhat emaciated, and weak rather than robust in handling quality. Even if management or environment have been responsible for poor flesh and wasted condition in the fall of the year the breeder cannot be sure that such is the case and it is the better part of wisdom for him to stick rather tenaciously to this rule of insisting upon a good, firm condition of flesh in prospective breeding stock at this time.

b. Absence of any sort of lesions, sores, or other external evidences of diseased conditions. Too often the egg farmer may be tempted to include a fowl which has made a good record but which has come to the end of the laying year, suffering with some one or other of poultry ailments. It is quite possible for a good layer to become affected with some disease and be rendered less useful or really useless as a future breeder thereby. In this book in every part of the practical management program which is suggested effort is directed toward "taking fewer chances" and, in place, "establishing more reliable and sounder methods." In a business like egg farming the element of chance must be decreased wherever and whenever possible. And so in this point, it is better not to take the chance that a fowl of good record but showing symptoms of disease will be safe to use for propagation of future laying flocks. Its presence in the breeding flocks and on the plant is in itself inadvisable.

c. A simple and useful practice on the egg farm throughout the year is to "black-band" any fowls, male or female, which shows signs of weakness, abnormalities, disease, or lack of strong, vigorous health, so that, even though they may appear to be quite normal at the time that breeding flocks are being selected, no temptation will arise to make use of them. *Use a black celluloid leg band for* such purpose of *"danger" marking, and reserve black bands for such meaning at all times.* The reader will find this writer building up a scheme of color banding which it is intended will serve as a reliable guide to many plant operations and which will minimize bookkeeping and reduce overhead costs. Therefore, whenever during the year, some evidence of lack of this all-important characteristic of health is seen, use a black band. It will do much toward reducing mortality in subsequent laying flock.

d. An alert carriage of body, accompanied by an active, nervous temperament is usually indicative of inherent health. The inherently weak fowl is liable to be droopy, listless in some degree, knock-kneed, and lacking in robustness and vigor of action and carriage.

e. Eliminate weak-looking, poor type individuals, male or female, from the poultry flocks, young or adult, throughout the season whenever such specimens appear. They will always prove to be uneconomical, if allowed to remain in the flocks, and may become very real potential sources of losses unless removed when first noticed. It rarely, if ever, pays the egg farmer to spend time and effort and money on other than healthy, strong stock.

The Principal Agencies Which Tend to Destroy Poultry Health.—No program of egg farm management can satisfactorily safeguard the health and productive capacities of its growing stock or layers or breeders unless the general causes of the destruction of such health and vigor are at least somewhat understood. Egg farming is coming into that group of production enterprises which forestall losses to at least a considerable extent by proper planning and by the use of precautionary measures. Truly "an ounce of prevention is worth a pound of cure." This book does not venture into the broad and comprehensive field of poultry diseases or pathology, but will try to outline a practical management scheme which, if used, will do much toward cutting down on both young stock and adult fowl mortality rates.

The principal agencies which tend to destroy normal, natural poultry health and productivity might be classified as follows:

1. *Communicable diseases* caused by organisms, such as bacteria, coccidia, protozoa, viruses, etc., which, when established within the poultry plant, destroy health, lower egg yields, and finally result in mortality. The poultry pathologist will tell us of several hundreds of such poultry diseases, each of which is definitely known to be caused by the presence in the poultry body of some disease-causing organisms. These poultry ailments are widely

varied. The modes of distribution of the infecting organisms are vastly different. These diseases range from those of little significance to those which sweep through large areas and destroy vast numbers of fowls and break down potential production possibilities. The egg farmer has but to investigate such well-known poultry diseases as Pullorum Disease, Coccidiosis, Blackhead, Infectious Laryngotracheitis, and Fowl Pox to find examples of this particular causative agency of the destruction of poultry health. This is not a place to attempt to go into any discussion of any of these poultry ailments. There are many publications available which describe common poultry diseases in detail. Here, merely is it desirable to point out the economic significance of this great list of disease organisms as one of the most important groups of principal agencies of the break down of poultry health and production. In this regard, it is suggested that the following steps should be undertaken by every egg farmer, at least in such degree as he may find it possible to do so:

a. Whenever opportunity is afforded to find out about specific poultry diseases, take advantage of it. Read up on poultry diseases even though cases have not yet appeared. It is of great value to be able to recognize onsetting disease during the first symptoms. Do not avoid discussions of poultry diseases, as is so often done. Egg farmers should acquire as much information, specific in character, as may be had. Procure bulletins and circulars on these subjects.

b. Whenever a case of disease occurs on the egg farm make every possible effort to identify it in order to be able to set up some sort of preventive management against further occurrences. It is the case of poultry disease which is allowed to go uninvestigated which often leads to serious economic losses because important control measures have not been used in the early stages of its appearance on the plant. Of course, it is not always possible to get this desirable diagnosis and advice as to what should be done, but in many instances it is entirely possible. At least, no disease case should be disposed of without some effort having been made to learn the cause and nature of the malady and what might be done to insure against further losses due to the same cause. Get in touch with some (a) poultry pathologist at some state or federal institution, (b) or some County Agricultural Agent, (c) or some experienced poultryman. In time the average egg farmer can educate himself to recognize the symptoms of the more common poultry diseases.

c. Assume that every fowl, young or old, which dies on the plant has been the victim of some disease of communicable nature, unless knowledge to the contrary is at hand. In this way much may be done toward stopping the spread of communicable diseases. Take prompt action whenever poultry disease appears. Delay spells further trouble, as a rule. Suggested items in this respect are:

1. Make a frequent inspection trip through the houses or yards where fowls are being kept, young

and old, usually daily, looking for signs of diseased specimens. Prompt removal of sick fowls from the midst of healthy ones is a first principle of sanitary poultry management.

2. Preferably examine the sick fowl, or have it examined, to determine the cause and nature of the ailment, if possible, and then destroy it by burning. Fire will do away with any organisms of disease which might be in that carcass. If burning is not practicable, destroy the carcass by deep burial in a plot of ground not used by poultry and not located near a water supply. Cover very carefully with sufficient soil to prevent dogs or other animals from digging it up, or to prevent bad odors from rising therefrom. It rarely pays to try to maintain a hospital for the treatment of sick fowls on an egg farm. Few, if any, "recovered" birds ever become active, vigorous, economical layers again.

3. Keep a record of each fowl removed from each flock, as to date of removal, cause (in a general way, at least), and any specific information which may be gleaned concerning the case. Such a "removal record" is an important part of the record system which should be a part of every egg farmer's management plan. The record of removals and mortality cases over a season often leads to changes in management which may correct serious errors and turn losses over into profits. To go on in ignorance of the real toll which disease does take from the poultry flock during an average year, and to make no effort to identify the causes of it is inexcusable

in these modern days of egg farming as a specialized business.

4. Upon ascertaining the identity of disease cases on the plant determine, if possible, what practical steps may be taken toward eradication of the causes of that trouble, and then take measures headed toward such improved management. If modern egg farmers are to maintain their flocks on a sanitary, healthy basis and keep mortality losses to a minimum, strenuous action is called for. Disease germs do their deadly work whenever the poultryman becomes lax in his sanitary care and management of his plant and flocks.

2. *Ailments Due to Wrong Environmental Conditions.*—Probably along with disease-producing organisms must be mentioned environmental conditions which break down the health and productive tendencies of fowls. These agencies include drafts in poorly constructed poultry houses, dampness, especially in floors and floor litter, lack of heat, especially in care of young chicks, causing chilling, overcrowding, in both young and adult poultry flocks, and similar conditions under which poultry cannot normally continue in natural health and strength. This group of causative agencies of disease on egg farms is serious because it is widely spread and common in occurrence. Lack of education, training, experience, and capital are the usual reasons back of the occurrence of these physical agencies of trouble. It is obvious that the management of the plant may be made to correct such factors once their sig-

nificance and effectiveness in the destruction of the health of the fowls is understood and appreciated. In this same category must go the accumulation of unsanitary, unclean environmental conditions within the poultry domain, due to a lack of proper care of litter, failure to remove manure properly and sufficiently often, non-use of disinfectant sprays of any kind, too constant use of unturned surface soil in the poultry yards, etc. In the outline of a sanitary management scheme a little later in the chapter the removal of these agencies causing poultry losses will be dealt with and from a disease-preventing point of view.

3. *Physical Agencies Causing Poultry Mortality or Sickness.*—On too many egg farms both young fowls and adults are lost each year due to purely physical ailments, that is through troubles which are not attributable, in so far as we now know at least, to either disease organisms or to unsuitable factors in the surroundings of the fowls. For example, cannibalism, or "pick-outs," removes many fowls each season from laying flocks. Fowls form bad habits, some of which result in serious injuries, and often in mortality cases. Chilling kills or stunts the growth of many chicks. Freezing of combs and wattles of breeders lowers vitality, interferes with fertility and hatchability, and may cause loss of life. Some fowls hang themselves in trapnests. There are scores of physical causes of mortality. The fowls thus removed are just as definite a loss of potential

earnings as are those which were removed due to the coming of some fearsome disease onto the plant.

4. *Parasitic Enemies of Poultry.*—Lice, mites, worms of all sorts and types, and such parasitic forms of life are commonly to be found in poultry plants, and constitute a real agency of destruction to the health and production of poultry flocks. Their place in the order of things must be recognized, and, as was suggested in the case of communicable diseases, much the same course must be taken in fighting the economic losses due to parasites as has been mentioned for the fight against germ-caused diseases.

5. *Hereditary Weaknesses.*—It is probable that no small part of the modern egg farmer's problem may lie in the intangible and little understood inherited weaknesses which seem to account for many cases of failure of fowls to live through the year under average management conditions. This writer suggests that his twenty-five years of experience and observation leads him to suggest that in the ordinary, average poultry flock there may be approximately five per cent of the fowls which go into laying quarters in the fall of each year which are inherently lacking in natural strength and capacity to stand up under modern feeding and forcing for egg yield. In other words, one may have to assume that something like this number of fowls will drop off during the business year from causes which must be assigned to some inherent weaknesses in those fowls. Through breeder selection and flock improvement,

carried on over a series of years, it should be possible to considerably reduce this cause of mortality and lowered production. Yet, since inheritance is as complicated as it apparently is, and since poultrymen and egg farmers must necessarily attempt to bring about improvement in the poultry being bred in many different respects at the same time, it will be a long time before the average poultry farmer may reasonably expect to eliminate this approximately five per cent of annual losses due to inherited weaknesses.

The suggested classification of causative agencies of poultry disease just given has not been an attempt to be complete or to be descriptive in any detail, but rather to point out in this book on the business management of an egg farm the important fact that poultrymen have several types of problems to face with regard to the maintenance of poultry health and the control of mortality in poultry flocks.

A "POULTRY HEALTH MAINTENANCE" MANAGEMENT PROGRAM

In order to be specific and practical in this matter of poultry health maintenance, or poultry disease control or prevention, an attempt will be made to outline certain steps in the everyday management of the egg farm which, it is felt, will be effective in accomplishing the following important business objectives:

1. The securing of sound, healthy poultry stock.

2. The maintaining of such stock in normal, natural condition.

3. The prevention of disease-producing agencies gaining foothold on the egg farm.

4. The control of such agencies if and when they do appear.

Fig. 28.—An inherently strong, vigorous flock of White Leghorn layers, the result of several years of consistent effort to reduce losses due to mortality through flock improvement methods.

5. The holding of losses, both in actual poultry and in egg yields, to a minimum.

6. The prevention of future attacks in so far as possible.

7. The repair of injuries done to the egg farm due to the experiences which have caused losses of fowls or decreased egg yields.

As has been hinted in preceding pages, it is assumed that the average egg farmer will usually be a poultry breeder also, at least to the extent of "producing his own" pullets, or layer replacements. For this reason it is necessary to consider sanitary management from the standpoint of rearing young stock as well as from that of managing adult stock, layers and breeders. It is also to be pointed out that probably not all of the following management points will be useful on every egg farm, but from the list of those given in this place it is probable that the average egg farmer may find those which are economically useful and feasible for him and for use on his plant.

I. **Healthy Foundation Stock Is a First Essential.**—Whether such sound, inherently vigorous stock is to come from one's own line of breeding and selection or is to be secured through purchase in any stage of development, from hatching egg to breeding sire, matters little. Successful egg production, from a business point of view, depends very largely upon the native vigor and constitutional strength possessed by the fowls of any given flock. How is such stock to be secured?

a. When the egg farmer is breeding his own stock, through the adoption and carrying of line-breeding and a poultry breeder selection program in which natural health and vigor of every individual used is a matter of paramount consideration, as has been outlined in a previous chapter. If new blood is desired from time to time, the same sanitary and precautionary steps are advised as are outlined below for use when new stock is annually secured as chicks, etc.

b. When the egg farmer is securing layer replacements by purchase, either in whole or in part, each season, as is so often a practice, the steps in sanitary management may be somewhat as follows:

1. Secure new stock by means of such methods as will (a) help to insure obtaining layer replacement stock ready for laying quarters in the fall at a minimum cost charge, consistent with high quality, and (b) reduce the chances of introduction of disease to lowest possible level. This point may well be stressed from the point of view of the producer as well as the buyer of such stock, for permanent business in either line must be built upon a sound foundation of honest product, bought or sold. For the average egg farmer these means of securing new stock, to meet the above requirements, may be limited to these:

a. Purchase of *hatching eggs* from a reliable source, where at least some effort has been made to improve the quality of the strain of fowls being bred and where some sanitary precautions have been practiced. Attempt to find a source of hatching eggs which is like that which one would set up for himself, if that were possible. Then it matters little whether the egg farmer does his own breeding or purchases stock from the one who does. The bringing of hatching eggs onto the farm from some outside source probably is least liable to bring disease onto the place of any of the possible forms of stock introduction. The poultry pathologists agree to this, we believe. The purchase of hatching eggs may oftentimes result in the placing of chicks under the brooders at a lower cost than as if day-old chicks had been purchased. The use of hatching eggs as a source of new pullets, however, does entail the necessity of having incubator equipment on the egg farm. That is frequently already possessed and there is then no problem of further outlay of capital to be considered. The egg farmer must take these various points into consideration and then decide as to whether or not hatching eggs may be the best form through which to secure new stock. If it is felt that purchased hatching eggs are to be used, several inquiries should be made concerning them, and these are identical with those mentioned just below in connection with the purchase of day-old chicks. If eggs are to be used, it is advisable to secure them as near at hand as may be possible, for long shipments do not enhance chances of hatchability, it has been the experience of the writer.

b. Purchase of *day-old chicks* from a reliable source. On some egg farms and in some seasons and at some special times on any farm it may be quite economical, all things taken into account, to secure additional stock through the purchase of day-old chicks. Again, as in the case of the purchase of hatching eggs, the introduction of new stock in this form (chicks) may be made to meet both of the fundamental requirements above mentioned. Layers from purchased chicks will be as good in quality as the stock whence they were produced on the home plant. It therefore behooves every purchaser of day-old chicks to look well to the background of every lot of chicks bought and to never assume that just live, apparently active, strong chicks will suffice. In the interests of both future growth and production as well as the health conditions on the poultry plant it is suggested that at least the following points of inquiry be made:

1. What egg production tendencies are behind the chicks? What sort of breeder selection has been practiced? Have pedigreed male birds been used as sires? Have poor quality birds been left out of the breeding flocks from whence the chicks came? Or, in short, find out what sort of breeding program has been used to produce the chicks in question. The purchaser has every right to ask for and demand quality of breeding in chicks purchased. Chick producers and hatcherymen must come more and more each year to the position in which they can furnish the same high quality of well-bred chicks that might be bred and produced on any poultry breeding plant. It probably means a closer supervision of farm breeding flocks on the part of hatcherymen buying eggs for chick production purposes.

2. Are the chicks from hens and male birds which have been tested for the presence of Pullorum Disease (B.W.D.) carriers, and have such carriers been removed from the breeding flocks previous to the saving of hatching eggs? Better still, do the chicks

come from Pullorum-free flocks? At least make inquiry concerning the Pullorum Disease status of the chicks. There should be little need in these days for egg farmers to have to buy chicks from Pullorum-infected flocks, and thereby court possible disaster through heavy losses due to this common chick disease.

3. If possible, ascertain if the source flocks have been troubled with fowl paralysis, and, again, if possible, secure chicks from paralysis-free strains. Such are not easy to find yet, and still in the future more consideration must be given to this baffling disease problem of paralysis.

4. What special characteristics have the producers of the chicks been breeding for?

2. Secure chicks as near home as possible, avoiding long distance hauls whenever it may be done without sacrifice of quality or saving in chick costs, and get chicks by personal delivery preferably. The sooner new chicks can be placed under the brooder hovers after they are 24 hours old the better.

3. Plan the chick season carefully so as to make best possible use of brooder and, later, rearing equipment. For the average egg farmer it is suggested that the chick crop might well be divided approximately as follows: (a) one-quarter of the season's numbers as early-hatched chicks, that is secured during January or February, to furnish layers coming into maturity in late summer or early fall; (b) one-half of the flocks as medium-season hatches, that is during March and through about the third week

in April, bringing pullets into egg-laying maturity about the first of October; and (c) the remaining quarter as late-hatched stock, that is late April, May, or in some localities even into June, furnishing layers ready about November first.

4. For every brood of chicks, and this is equally true for purchased chicks as for home-bred chicks plan the care and management ahead of their actual arrival in such manner as to insure a good chance of normal, healthful development, economically brought about.

II. **A Start Under Sanitary Environmental Conditions.**—There are greater sanitary problems facing chick raisers today than was true a few years ago. Many situations within the poultry industry combine to make this so. The egg farmer need worry little about why this state of things has come about, but he must worry about what he has to do about it, since it is unquestionably true. He must give his chick flocks the fairest chance to get a healthful start. He must start at the very beginnings of their careers in his efforts to give them an even break, especially since the general methods which he must use are artificial and unnatural in character, and quite far removed from the natural brooding methods of former days. Just what comprises such a sanitary start-off might be summed up as follows:

1. Prior to the receiving of the chicks the brooder house or room should be sanitarily prepared so that all chances of the chicks coming in contact with disease germs which may have been lurking in that

brooder place may be eliminated. Chicks deserve the even break of being placed in a clean, disinfected environment when they are started on the road to growth and development. Such sanitary preparation may be supplied by:

a. Sweeping down the walls and ceiling, thus removing cob-webs and collected dirt which may be harboring disease-producing organisms or dangerous parasites.

b. Thoroughly scrape the floor, removing all old litter and the sweepings from walls and ceiling.

c. With a force sprayer, an indispensable part of the regular equipment of every egg farm, thoroughly spray the entire interior of the brooder house, wetting all parts and driving the spray into cracks and crevices, and allowing the surplus to accumulate and stand for a little time on the floor. Use a 5% solution of any good disinfectant, such as one of those of coal-tar derivation, having a guaranteed high phenol coefficient, that is a high germ-destroying power. Preferably use hot water in making this solution and apply hot. This disinfection should be done at the beginning of the season, and at least two full days before the chicks are expected. It will require at least 24 hours in which to dry out. Time is an important element in securing effective disinfection.

d. After the brooder house has well dried out after having been disinfected, supply clean litter. There are several good types of litter which may be used for chicks. One which is satisfactory from

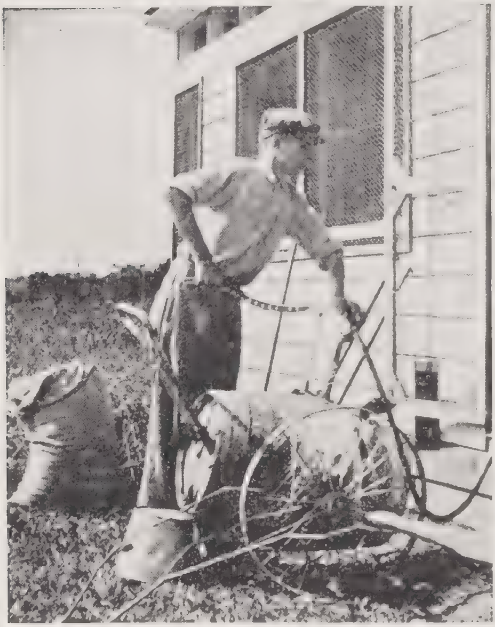


Fig. 29.—The half-barrel force sprayer becomes an equipment of year-round usefulness on the modern egg farm, in the waging of the battle against infection.

the sanitary, as well as the economic point of view, is a litter made of coarsely ground corn cobs. It is light, not dusty, and absorptive. Another is peanut shells. Another litter which the author has used with success is coarse sand, to a depth of approximately an inch, covered lightly with barn floor chaff, or chopped straw, or other clean, absorptive material. Avoid a litter which becomes dusty quickly, or one which packs down solidly after a few days use. The litter should not have been in contact with older poultry of any kind prior to its use in brooding work.

e. Set up the brooder stove approximately 24 hours before the chicks are to be placed under it, checking carefully to make sure that all parts are present and functioning properly. The brooder stove should register proper temperature and carry it evenly and reliably for at least a full day before the chicks are entrusted to it. This is very distinctly an item influencing the health of the chicks, and as such belongs to the sanitary program of management.

f. Limit the size of flock placed under one brooder stove. This is a point of highest significance. A safe rule would be to limit the size of chick flocks to a maximum of 300 chicks under one stove or handled as one unit. 250 would be even safer, for most situations.

g. Provide sufficient room for each unit flock, which is approximately 120 sq. ft., preferably furnished by a space 10 ft. wide by 12 ft. deep. This room space allowance should suffice for the first three weeks, but after that time double that amount of floor area is required, or the chicks must be let out of doors into yards.

III. **An Efficient, Economical Growing Ration.**—The chick ration in all its parts constitutes a vital factor in a sanitary growing program calculated to reduce mortality rates amongst growing chicks. Its place in such a health program is but indicated here, since the details of a chick feeding program will be outlined in a later chapter.

IV. **An Environment Conducive to Healthful**

Development. — Much of the future health, strength, vigor, activity, and productivity of poultry flocks is built up and insured during the period of growth and development between hatching time and maturity to first egg. This is the season during which environment and management become highly influential factors in determining the degree of liveability and productive tendency which will be shown by mature stock in ensuing months. There are several methods of rearing young poultry stock in a sanitary, health-protective manner and which will develop pullets of vigor and health as they reach maturity:

1. *The extensive, or range system, of rearing young stock* is widely used throughout the country, and especially in sections where ample acreage is still available on the farm to permit of such practice. For the average egg farmer it is probable that the range-rearing of future layers is, all things considered, the most economical and safest system to use. From the point of view of effect on health and productivity, there is much to be said in favor of the open air range method. There are two principal types of poultry range management which may be employed in the raising of healthy pullets:

a. The crop-rotation method, in which the flocks of growing pullets and cockerels are considered as one of the rotating or moving crops. Such a crop-rotation scheme is not feasible on the small farm, but on the farm of many acres it is often very practical and economical, not only from the standpoint of the growing of healthy pullets but from the point of view of improving other farm crops as well. Crop-rotation schemes may vary as to (1) the number of years included and therefore the frequency with which pullet flocks will be pastured on the given range area, and also as to (2) the kinds and types of field crops used. Lack of space here limits this discussion to a brief presentation of workable crop-rotation plans which this author has observed in economical use or has himself used with satisfactory results.

1. A practical and useful four-year crop-rotation scheme consists of such a plan as follows:

Field A, in any given year, is a second-year alfalfa, or red clover, sod. The growing pullets are using this field throughout the summer and early fall seasons. The optimum usage of such a field or range for growing young stock may be brought about by (a) allocating not more than 300 youngsters to the acre, by (b) dividing that flock into 5 flock-units, of 60 pullets each, by (c) placing each colony of 60 pullets in a range-shelter or colony house, and by (d) distributing the shelters or colony houses about each acre so that the entire area is being used and no one part of it over-worked by the poultry stock.

Field B, in that same year, is not used for poultry, but is growing a first-season alfalfa or red clover crop, a sales crop, for such hay usually commands a good price. It is on this Field B that the next season's pullet crop will be ranged.

Field C, again in the same year, will be plowed in early spring, sown to oats, barley or similar short-season cereal crop, harvested as a cash or sales crop. By mid-summer such crop will have been harvested and the land can be plowed again and seeded down to the alfalfa or red clover, whichever may be selected. Poultry like either, and either crop forms a marketable hay of value.

Field D, fourth in the series, in that year will be used for some cultivated crop, such as corn.

Such a four-year rotation uses the land but one year out of four for the ranging of the young poultry stock. In the other three years the soil will have been turned under several times, well weathered, and rendered sanitary through cultivation and manipulation for the proper growing of the crops mentioned.

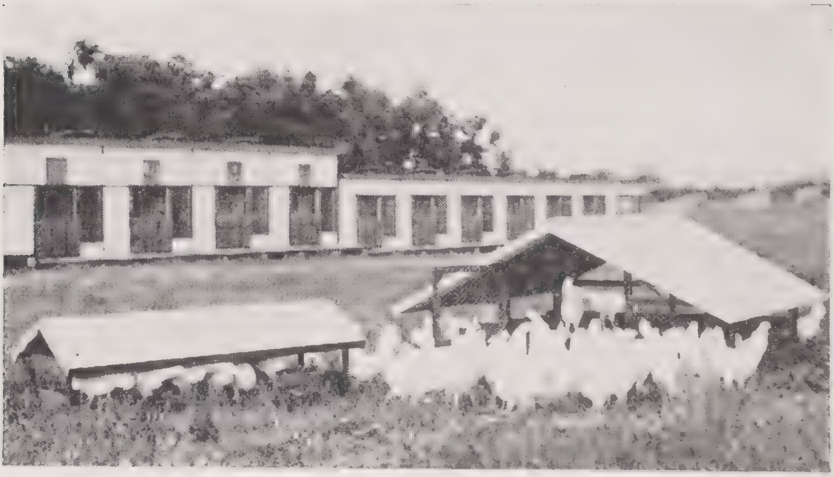


Fig. 30.—White Leghorn pullets in a 60-bird colony, living in a New Jersey collapsible summer shelter, on a green range during summer.

2. On egg farms of smaller acreage it may not be possible to manage the fields in such a manner as to use any one of them but once in three or four years for chick-growing. A two-year crop-rotation scheme is a feasible proposition in such situations. Under such a plan

Field A, in a given season, will be used for the pullets as a range. It may (a) have been sown to alfalfa or red clover during the previous fall, in which case it would be growing a first-year stand of the leguminous crop while the chicks are ranging over it. This would be fine, from the pullets' point of view, but less economical from the farmer's standpoint. Or, (b) this Field A might have been sown to winter wheat in the previous fall, carried over winter primarily as a green manure crop, furnishing early spring green crop for the earliest pullets, then plowed under and succeeded by a crop of oats and Canadian field peas. The peas and oats would be harvested in mid-summer and the ranges sown to buckwheat. These are workable suggestions only. Other combinations might prove more satisfactory in certain localities. It is the idea of the thing that is important, to grow the chickens on ranges which have recently been cultivated, the surface soil turned under, and surface pollution destroyed, and where a green crop of some sort is provided for the chickens on range.

Field B, not used for chicks in that year, would be plowed well and used for some cash crop, either some cultivated crop, such as corn, potatoes, cabbages, etc., or some small grain crop, especially if the leguminous crop were to be sown in the fall.

This two-year rotation scheme, rightly worked, should insure a healthful type of poultry-growing range for use during summer months.

The range method of rearing young poultry stock, replacement layers and future breeding sires alike, is still a safe and sane method for the average poultry keeper to follow. It may be made to furnish the fundamental environmental factors essential to vigorous and healthy development, that is steady, continuous growth, and a minimum of ill-health, disease, and losses. Those factors include:

a. Abundance of fresh, pure air, both day and night during the growing season.

b. The vitamin D, anti-rachitic factors of direct sunlight and possibly other beneficial effects of exposure to real sunshine.

c. Space, allowing growing birds to get away from close contacts with one another and to get away from polluted areas of ground, to come into contact with fresh, clean earth.

d. Green, succulent food, such as any of the crops mentioned above will readily furnish throughout the growing season.

In any range system of pullet-rearing there are the two phases to be considered, especially from this angle of health maintenance and insurance: one is the soil, the land, the management of which has already been outlined above, and the other is the buildings, the colony houses or range shelters which

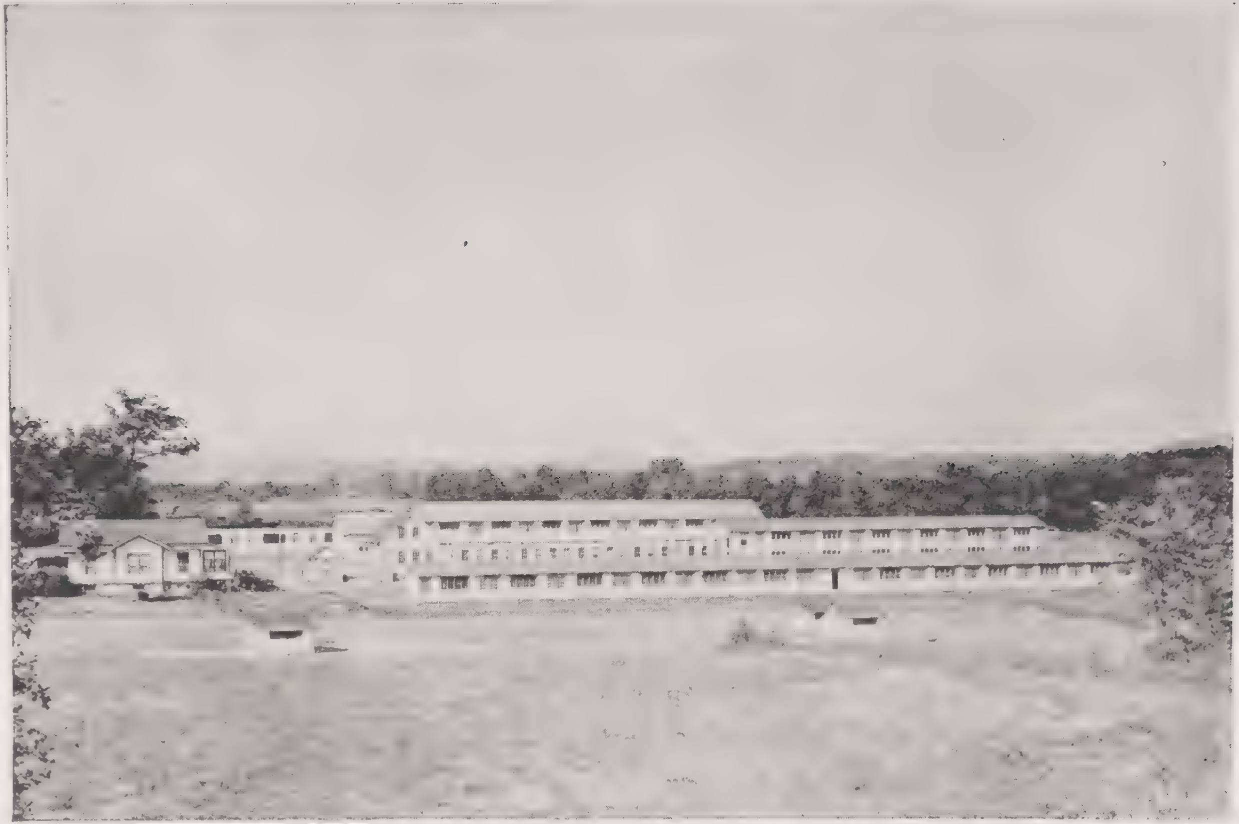


Fig. 31.—This commercial egg farm, in Morris County, New Jersey, believes in strictly modern Methods. Its thousands of pullets are reared on wide grass-covered ranges through each Summer.

will protect the birds during bad weather and at night. A further word as to the sanitary care of the houses with which growing chicks come into contact during summer days is in order at this point. The arrangement of them according to the plan suggested above should avoid over-crowding, which evil can destroy the whole health of the flocks in a short time if allowed to take place. Therefore, the management of poultry range houses, to enhance and maintain poultry health among the growing chicks may be summarized as follows:

a. At beginning of range season, thoroughly clean and disinfect the colony houses or shelters.

b. Furnish fresh, clean, non-dusty litter—in types of houses requiring same—and keep it changed or replenished frequently through the season, judging by conditions, of course.

c. Police the ranges and houses daily throughout the growing season, immediately removing sources of carrion flesh, and otherwise seeing to it that the environment of the flocks is not dangerous.

d. Provide ample water and feed troughs and hoppers so that all growing chicks may be able to eat and drink whenever they so desire throughout the growing season.

e. If the ranges are open fields, some sort of artificially created shade should be provided, for, although growing chicks do need the direct rays of the sun, the intense heat of summer-time may be too much for them and they will need protection against it. A good practice consists of painting the roofs of the colony houses or shelters white or silver, for such houses are often used by the chickens much during mid-day hours.

2. *The semi-intensive, or close-confinement-to-house* system of rearing poultry young stock has come into rather general use whenever either or both of the following conditions prevail: (a) land area for growing range purposes is very limited or even non-existent, or where neighborhood situations prevents range-growing of chicks, or (b) the long-continued over-use of the same soil area, year after year, for young stock growing has resulted in a serious infestation with parasites, such as round worms, etc., or other infection or pollution which has rendered such soil unsafe for the ranging of young birds on it. This method has been worked out in a variety of ways, but in each case the fundamental principles are the same.

a. One way of brooding chicks and rearing them to maturity in close confinement to buildings, that is away from contact with the soil, is constituted of

1. Starting the colonies, as usual, (that is, a maximum of 300 chicks under one stove and in one unit, approximately 10′ x 12′ in size), and

2. At the end of third or during the fourth week, separating the sexes, if possible, (usually possible with Leghorns, in which the earmarks of sex differentiation appear at that time), and moving the cockerels to other quarters to be finished as broilers, etc., or

3. At that time, dividing the flocks by half, or doubling the available floor space;

4. The use of double-pen brooder houses, one warm pen and one cool pen, while requiring double housing allowance, does satisfy the requirement for unusually successful brooding-in-confinement-to-buildings.

5. At approximately six or seven weeks of age the growing pullets will again need more space and at about that time should be thinned down to unit growing flocks of not more than 60 individuals, the same as advocated for range growing. This, again, requires added housing space, but this method does always require from double to treble the amount of housing space as is needed for ordinary range rearing. Of course, if capital is not invested in acres and range equipment, it can be invested in added housing area without greatly increasing the actual per-bird investment in rearing equipment.

Under this scheme, in order to furnish the same essential factors which have been enumerated as pertaining to satisfactory growth of young stock, and accomplish normal development economically, it must be appreciated that

a. Considerably more labor will be involved throughout the growing season, especially in connection with maintaining the environment in sanitary condition.

b. Rations must furnish enough milk, green food, cod-liver oil, and similar food supplements, to make up for lack of direct sunshine.

c. Constant attention must be given to providing ample ventilation in the houses used for growing birds, because of their being constantly confined therein.

d. The environment of the developing chicks is artificial, limited in extent, and may be subject to exact and effective sanitary management.

Good strong, healthy pullets and cockerels have been reared in close confinement to buildings. Usually it may safely be estimated that the cost of such rearing will be somewhat greater than obtains under range rearing, often being increased from half again to double as much. If, however, range rearing is not a possibility on some given egg farm, the use of this scheme, in spite of increased cost per bird, will have to be used.

b. Another variation of this confinement method of pullet-rearing involves the use of wire-bottom porches. It is usual to allow a porch area equal in size to the colony house or pen itself. This porch may or may not be screened, as a protection against house or stable flies, intermediate hosts of certain internal parasites, notably tape worms. In some instances the use of screens is certainly to be advocated, but their use on the porches must be accompanied by a complete screening of the entire colony house, even including a screened entrance. Also, this method of rearing chicks may be varied through the use of wire-bottom floors within the brooder pens. The writer has not found this method economical or necessary, as a rule.

V. Provision of Sanitary Environmental Conditions for the Laying Flocks.—It is necessary only briefly to suggest the points which enter into a management program looking toward keeping mortality rates to a minimum in adult, laying flocks.

1. *The allocation of well-bred, well-grown pullets to laying flock units in the fall of the year* has a most important bearing upon the matter of health and productivity.

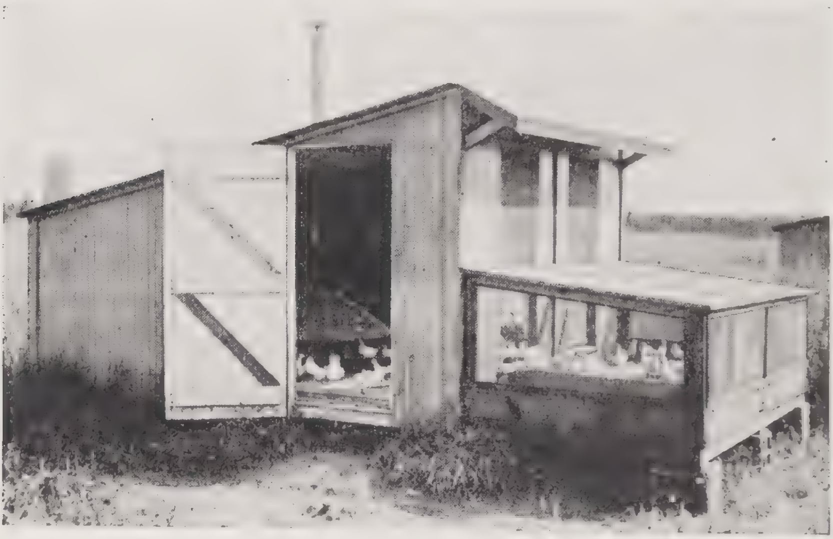


Fig. 32.—A Colony Brooder House, with wire-bottom porch and with similar floor type within the house.

a. Preferably place pullets of about the same stage of development and of about similar laying capacities together, using whatever knowledge is at hand, such as date of hatch, parentage, individual quality and development (appearance at time of handling), and history of the rearing period. It is a mistake to place half-grown, immature pullets in the same laying quarters with full-grown, ready-to-lay birds, if possible to avoid it.

b. Employ "age at first egg" as a chief criterion in assignment of pullets to laying flock units. This means that every pullet reared on the plant should have been marked, as by a system of toe-punching, so that in the fall the date of hatch and therefore rate of development could easily be determined for each individual handled.

c. Cull the pullets carefully at the time of placing them in laying quarters. Too often really poor quality pullets are allowed entrance to laying quarters on the chance that they may come along reasonably satisfactorily. Usually they do not do so. Pullets, to merit inclusion in laying flocks, should show strong, robust health, good flesh condition, and individual quality, in the fall.

2. *Limit the size of laying flock units.*—In order to get and keep control over laying flocks with any degree of success it is essential to limit the size of flock units. Invariably layers do better when divided into reasonably small flocks. Considering all factors, it is suggested that 100 laying pullets constitutes an economical flock unit. 125 is a maximum for best results.

3. *Rigid adherence to floor space allotment rule* is necessary, in order to furnish an important contribution to a form of management which it is believed will tend to hold mortality to a low rate and

maintain production at an economical and profitable level. *Four square feet of floor space per layer* is suggested, and this is to be applied at the time of year when the pullets are moved into laying houses.

4. *Sanitary preparation of laying quarters prior to bringing in new pullet flocks is necessary.*—This includes removal of former occupants of pens, the sweeping down of walls and ceilings, the removal of all old litter, dirt, manure, etc., the spraying of the entire interior with a 5% disinfectant solution, or the use of a disinfectant white-wash for all interior walls and ceilings (the writer strongly recommends the use of white-wash or some sort of water paint which will leave the interior white and bright), and the thorough cleaning and disinfection of all movable equipment, such as nests, hoppers, water pans, etc. New litter for nests and floors must be supplied.

5. *Frequent attention to the sanitation of the laying houses throughout the season.*

6. *Keep layers of different ages separated.*—Pullets should not be mixed with yearlings and older hen flocks, but should be kept separately through their first laying year, as a sanitary precaution and for best production results. In similar way, on the growing ranges, young stock should never be run with old stock, but kept entirely to itself.

7. *Provide ample ventilation in the laying houses*, that is plenty of fresh air. Ways and means of doing this will be discussed in a later chapter. It has its place, however, in the sanitary management set-up.

VI. **Protection of Prospective Layers Against Specific Diseases.**—There are a few poultry diseases against which egg farmers may, in these modern days, protect their stock, especially the growing pullets, and the selected breeders. Reference is made particularly to (1) vaccination of all pullets and cockerels (being reared for future breeding purposes or for development as mature meat stock) against fowl-pox, and (2) to vaccination of the same birds as a protection against infectious laryngotracheitis, under circumstances which call for this latter treatment. Usually such vaccinations are best done during the growing period when the chicks are approximately three to three and one-half months of age. Always, however, such protective vaccination should be done only under the advice of competent veterinarians or poultry pathologists. Complete literature is available on these subjects in many states. Reference is also made to the testing of adult flocks, especially breeders, for the presence of "carriers" of Pullorum Disease (B.W.D.). Losses due to these diseases may be eliminated from the modern egg farm by judicious planning.

VII. **The Quarantine Management of the Egg Farm.**—One of the most important points in any program of sanitary management, where serious effort is directed toward reduction of losses due to mortality, in either young or adult flocks, is the recognition and use of the principle of quarantine management all along the line throughout the year. Practically stated, this principle includes:

1. *Distinct limitation to movement of poultry stock onto the egg farm from any outside source* is necessary, and, if done, it must be accompanied by adequate precautionary measures to guard against the possible introduction of disease-producing agencies.

2. *Isolation of new adult stock* for at least three weeks before placing same with regular flocks of the plant. This may involve some bother, but the precaution is worth the trouble. If diseases are to appear in the new stock as the result of the change in environment, feeding, etc., they will usually show themselves within a short time after arrival. Before new birds are placed with the flocks they should be rigidly examined for the lesions or earmarks of the commoner poultry diseases, such as fowl-pox, cholera, etc. The writer advocates, especially in the cases of newly introduced males, the *vigorous washing of the head parts, shanks, and feet* with warm water and a good hand soap, *before they are transferred to the home flocks.*

3. *Do not allow visitors to enter pens.*—Visitors to both brooder house pens and to adult fowl quarters often, quite unwittingly, become sources of the spread of poultry diseases. There is little justification for modern egg farmers taking the risks involved in allowing anyone to visit the poultry pens at any time of the year. Of course, it is often a nice gesture to friends and business prospects to invite them to go through the plant. This can and should be done, however, without allowing such visitors to track through the pens. Such a rule, to be effective

in checking the spread of disease, must be enforced at all times during the year.

4. *Limit traffic through pens even amongst employees.*—This includes all persons working on the plant. It is usually possible to assign the care and management of each unit flock, pen, or house to some particular person. Such person, then, should be the one who will enter and work in the assigned place. Others should be kept out or allowed entrance only under most careful sanitary precaution, as mentioned below. This advice is contrary to average practice, but future egg farming must be better than today's average practice, if profits are to be assured.

5. *All persons entering young or old stock pens should use care to minimize the possibilities of carrying disease-producing agencies from place to place.*—It is not necessary to wait for the actual appearance of some disease before this precaution should be put into practice. It should be a rigid rule on every plant and at all times. One effective way to cut down on the chances of spreading disease germs is to require everyone entering any poultry pen to step into a disinfectant solution before entering. This may be put in a pan outside the entrance door, or a burlap bag may be kept saturated with the disinfectant, or rubbers may be used. To save just a few good, productive layers from contracting disease will much more than repay for this added expense and bother.

VIII. **Minimize the changing of flocks from place to place during the year.**—If the work of the plant has been properly planned and thought out in advance of the opening of the business year, it should be possible to allocate both young and old flocks to quarters from which, under normal circumstances, it should not be necessary to move them during the season. The principle should be recognized and then followed as tenaciously as may be possible. Every change in location and every move to new quarters, other things being equal, increase the chances of trouble occurring. The frequent mixing of birds from one flock to another is an unsafe practice and should be avoided whenever possible.

This chapter has made no attempt to discuss specific diseases. Readers are urged to consult the many reliable sources of such information for those details. Here it has been the object, rather, to lay down a general poultry flock management scheme which would tend to maintain a greater percentage of naturally healthy fowls in normal condition and thus in productivity. This discussion has dealt with principles primarily. It has been developed on the premise that it is economically sound to attempt to prevent the breaking down of normal, natural poultry health rather than to attempt to counteract disease agencies once established or to cure ailments already present. It has been developed, also, with the thought that present day experience has taught that some changes in management are needed, and that nothing short of real improvements in management will suffice to insure better results for the future.

V

METHODS AND PRACTICES OF CHICK PRODUCTION AND REARING ON THE EGG FARM

As has been hinted in previous pages, the modern egg farmer must look upon his chick-producing activities primarily as means of layer replacement. This is true whether the size of his operations is limited to the rearing of only a sufficient number of youngsters to meet the requirements of his own future flocks or is increased to permit of some sale of surplus young stock in some form or other. This chapter, then, is prepared from this business point of view. It will not discuss chick embryo development, or enter into details concerning nutritive requirements of chicks, or other items included in the usual field of chick consideration. It will adhere closely to a practical program of chick production and management which, it is believed by this writer, will prove adequate and economical for modern egg farmers to adopt.

The objectives of the egg farmer, as a chick producer and raiser, must be:

1. To so manage the breeders as to secure highest possible fertility, hatchability, and liveability of chicks.

2. To so operate the incubators, if such are at hand, as to secure a maximum percentage of hatch and a satisfactory quality of chick.

3. To so brood and rear the chicks at hand, produced or purchased as the case may be, as to grow and mature as nearly as may be possible 100% of the numbers placed in the brooders.

4. To so manage the young stock during the developing period as to keep costs to a minimum and produce ready-to-lay pullets and matured cockerels in the fall at lowest possible price, consistent with good quality.

Several steps in rearing management have already been presented in connection with the mortality-control program in the previous chapter. Such points will not be repeated in this chapter.

There are almost infinite ways and means of accomplishing these various objectives just enumerated. It is doubtful that there is any one best way of hatching, brooding, and rearing young stock. There are many satisfactory methods in common practice. There are many types of incubators and brooders on the market, practically all of which are satisfactory in operation. The poorer ones have dropped out of the competition, as a rule. This chapter leaves the selection of particular types or makes of incubators or brooders or equipment generally to the egg farmers themselves. They must be guided by the information which they secure from reliable sources in these matters of choosing specific machines from among the many offered.

The point here is directed rather toward the general principles of young stock rearing which might be found economically worth while, irrespective of the particular types of incubators or brooders which may be chosen for use.

I. **The Selection of Hatching Eggs.**—Here it is quite possible to place in brief, systematic form certain suggestions which relate to the selection of eggs suitable for hatching purposes, never forgetting the general improvement in average quality which is to be worked for in each succeeding year of the plant management.

a. Eggs used for chick-production purposes, that is for incubation, should have been produced by carefully selected breeders which have been mated approximately three to four weeks before the first eggs are set aside for incubation. On the average plant this means that early in December the breeding flocks should be made up and the male birds mated with them, and these flocks fed and managed for optimum hatching egg yield. The egg farmer of today cannot afford to be content with chicks from average run flocks, be they on his own place or from hatchery or other sources. The egg farmer must insist upon careful selection of breeders back of all eggs or chicks which he is to attempt to grow for layer replacement purposes. If he is to sell surplus pullets or cockerels for breeding purposes, he is equally bound to insist upon breeder selection back of all eggs or chicks which he uses.

b. Hatching eggs should not be stored or kept more than two weeks before being placed in incubators, for optimum results. Some poultrymen prefer not to exceed ten days, and others stretch this point to include three weeks. Set hatching eggs as soon as possible after they are a day or so old.

c. Hatching eggs, in most sections of the country, will be produced mainly during cold weather. Therefore, the precaution must be taken to avoid chilling or freezing of eggs which are destined for use in the incubators. This means

1. Gathering eggs from breeding flocks two or three times per day during cold weather.

2. Protecting the nests of the breeder hens by use of plenty of clean, dry litter, and possibly by erecting some sort of protection against the moving cold air within the poultry house.

3. Using an egg basket which will protect the eggs against chilling during transfer to the egg room.

4. Storing hatching eggs in a room above chilling or freezing temperature. An uniform, even temperature of about 50° F. is generally considered optimum for this purpose

d. Store eggs for hatching in clean cartons or crates or on grading tables which are scrupulously clean and free from bad odors, oil, or other soiling substances. The air should be moist rather than too dry.

e. Turn eggs at least once daily, preferably morning and night during the period of holding prior to incubation.

f. Not all eggs produced by average breeding hens are suitable for incubation purposes, as a rule, and some degree of selection should be exercised as the eggs are brought in from the pens or as they are sorted out and are being trayed for the machines. Look for the following points in all eggs to be incubated:

1. Preferable size. If the egg farmer is aiming toward the production of layers which will produce as nearly as may be possible 100% of eggs saleable under first-grade prices, as to size or weight, he must start selection toward that end at this stage. Use the "26" ounce rule, as outlined in the chapter on poultry breeding for increased egg yields above. Adhere rigidly to the size standard adopted, in order to accomplish noticeable improvement.

2. Normal egg shape. The average normal egg size is usually calculated to be one in which the short axis of the egg is to the long axis of that egg as 1 : 1¼. Select hatching eggs for such proportions and hatchability will be increased and the type of egg produced by the resultant pullets will tend to be more uniform and like that demanded by discriminating buyers of table eggs.

3. Sound strong egg shell. Hatching eggs which are soft and porous as to shell often crack or break in handling and hatch less normally than those with sound, natural shell texture.

4. Candle all eggs to be used for incubation, and eliminate any showing blood spots or other abnormal conditions within the shell.

Usually it may be expected that approximately

75% of the average gather of eggs from even well-selected breeder hens only will be found to pass these four tests and be found fit for incubation purposes. As the strain of fowls is improved by years of breeding and selection this percentage may be increased, and, of course, in some instances now as many as 100% of the eggs gathered may be found fit for incubation purposes, which means fit for chick production purposes.

g. Handle all eggs destined for incubation with care and keep them as clean as possible. Wash only in extreme cases, and then with a moist, clean cloth, or use a fine sand paper.

II. **Common Sense Incubator Operation Produces Results.**—For all types of artificial incubators on the present day market there are essentially four fundamental principles which are employed and these are the four factors primarily required for the normal, natural development and growth of chick embryos.

1. *Temperature.*—The optimum temperature for the normal development of the chick embryo is approximately 103° F. The modern incubator manufacturer so constructs his machine as to furnish this natural requirement. Various machines accomplish this objective through various mechanical means. The poultryman must study the directions furnished by the manufacturers of the specific incubator he is using, particularly with regard to the matter of heat or temperature. Attempt to follow operation directions explicitly. No definite rules

can be satisfactorily laid down which will apply to all types of modern incubators, obviously. Watch the matter of temperature closely, and manage to be in control of the heat supply at all times. Uniformity of temperature supply is generally conceded to be extremely important. It is always well, as a business record, to maintain a temperature chart for each hatch. Temperatures which run consistently higher than that of optimum will tend to bring the chicks out earlier than the 21st day, usually resulting in weakened vitality, if not, indeed, lowered hatchability and a decreased chance of good liveability. Temperatures which have run somewhat lower than optimum, on the other hand, tend to delay hatching time and also affect the health and strength of the chicks adversely.

Since the maintenance of an even temperature of the same degree throughout the hatch, or at least during the consecutive periods of the hatch is essential, it is imperative that the thermometers used should be absolutely accurate and trustworthy. Every incubator thermometer of the movable type should be tested against a known accurate thermometer at the beginning of each season and any necessary correction noted and calculated. Inaccurate thermometers have ruined many good quality hatching eggs.

Different makes of modern incubators employ widely differing methods of taking temperatures within the incubation chambers, and thus it is always necessary to ascertain, with regard to each type of incubator being used, the directions furnished by the manufacturers as to temperature levels required under the specific set-up of the given machine.

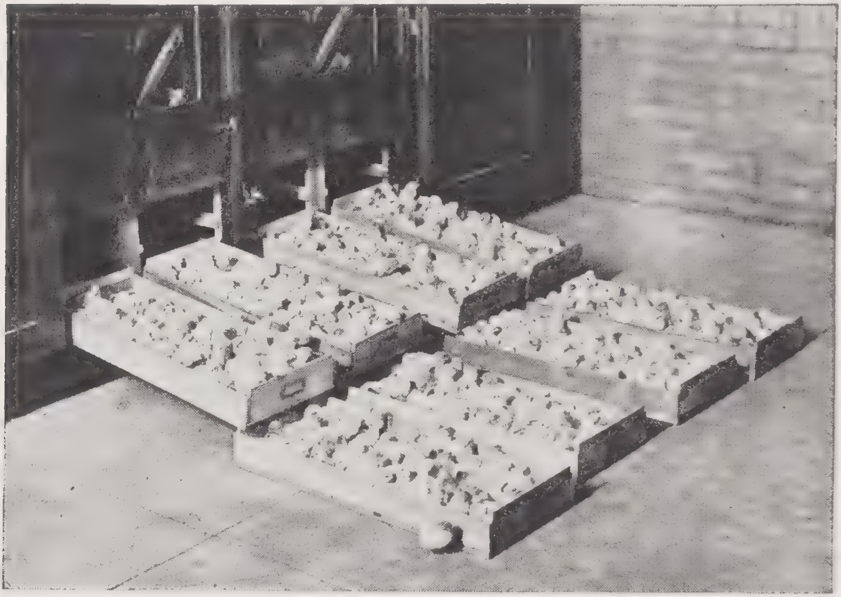


Fig. 33. A satisfactory hatch is one in which a high percentage of eggs set proved to be fertile, and in which a high percentage of such eggs hatched chicks of strong, vigorous vitality.

2. *Ventilation.*—Embryonic development is a process requiring a steady supply of oxygen, that is fresh air, and also a constant removal of the gases given off by the eggs as the germs within grow. The air within the incubator chambers must be clean and pure and fresh. Various types of modern machines accomplish this objective by means of widely different schemes of construction and operation. Again, manufacturers must accept the responsibility

of furnishing the best possible rules for ventilation of their respective incubators, and operators should be guided largely thereby. Of course, the room and surrounding conditions in which the incubators are being operated will vary somewhat and these may necessitate some changes in manufacturer's regulations. Experience alone in each given location must determine the changes required.

Incubators generally depend either upon (a) normal air flow through arranged in-take and outlet flues, or (b) forced draft, by means of fans or other mechanical devices for bringing about of air movement within the egg and chick chambers of the machines. Both methods, other things being equal, have been demonstrated to be workable and efficient. Incubator operators should become thoroughly familiar with the system of ventilation which characterizes the incubators being used and with the operating regulations which will have to be observed in order to furnish an optimum degree of ventilation during the hatch.

3. *Moisture.*—The normal development of the chick embryo within the shell during the 21 days of the normal incubation of hens' eggs results only if there is natural and normal degree of moisture-loss, or evaporation from within the egg, during that period. Normal development, also, will not take place if surrounding conditions prevent such natural rate of evaporation. This fundamental factor to natural embryonic development has likewise been taken into consideration by all reputable incubator

manufacturers in the setting up of their specific types of incubators, and, therefore, their own instructions, furnished with their machines, should be carefully studied and followed. Probably no two makes of modern incubator handle this matter of evaporation control, or moisture furnishing, in exactly the same way. The supplying of some moisture within the hatching chamber is usually a requirement at certain times during the incubation period.

Because temperature and ventilation, as well as moisture supplied, affect the rate of evaporation of eggs in the process of incubation, and because room conditions also affect this situation, it is often necessary to learn to adjust moisture supplying to any given type of incubator according to immediate requirements. An examination of the eggs themselves at several intervals during each hatch will quickly reveal whether or not evaporation is apparently taking place at least approximately normally. Experience in interpreting results under given sets of circumstances is soon acquired. No rules can be furnished, stating exactly what one should see under such examination.

4. *Change of Position.*—The mother hen, original hatcher for the poultry industry and still used on thousands of American farms and still efficient in that capacity, if given a fair chance, has been observed to turn the eggs upon which she patiently sits for three long weeks several times during the day. Artificial incubation secures improved hatch-

ability by imitating the hen in this regard. Eggs should be turned at least twice during each 24 hours, and many poultrymen increase that number to three or four or even more turnings in each day period. This matter, again, is definitely related to the other three fundamental factors to satisfactory incubation or embryonic development which have been mentioned above, and so it is incumbent upon the manufacturer of each artificial incubator to explain the operation of his machine with regard to egg-turning.

In the use of any particular type of modern incubator it is not only necessary to learn how to operate the machine as such, but it is equally necessary to appreciate that the mechanical operation of that machine, even though well nigh perfectly done, will not constitute all of the steps essential to good hatches. Among the other factors which will contribute to improved hatches are:

1. The parent stock back of any hatching eggs must have put into those eggs certain inherent characteristics which affect hatchability. It has already been pointed out in an earlier chapter that one of the most vital factors to bear in mind in breeder selection is "capacity to produce a high percentage of hatchable eggs." No incubator, however perfect in its mechanical construction and however efficient in its daily operation, can bring forth good hatches from eggs deficient in inherent strength and hatchability possibility.

2. Good stock, with hatchability records of established fact, may produce a good supply of eggs which,

in incubation, render an accounting below that which might reasonably be expected, and this simply because the eggs have been poorly handled between the time of their production and the time of their incubation. The rules which were given above should do away with poor hatches on this account.

3. Chicks must remain within the incubator chambers for several hours, ranging from about to 24 to 48 or even more in some cases, after hatching. Their first manure, or droppings, is caught on the floors of the trays. If those chicks, any of them, have hatched with an infection of such a disease as Pullorum Disease—the bacteria being then present in the intestinal contents of the baby chicks—that first-voided manure becomes at once a source of danger to all the chicks which may come in contact with it during those hours in the incubator trays. In other words, in a scheme of incubation which places many eggs and later many chicks within the same compartment is responsible for greatly increasing the risks to health of chicks hatched in the given machines. The very numbers of chicks which are usually produced within individual incubator compartments, irrespective of possible Pullorum or other disease infection, constitute a source of very considerable accumulation of down, dust, manure, shell bits, etc., all of which must be considered as breaking down the sanitary nature of the incubator. Every hatch of eggs must be operated under strictly sanitary regulations. Common sense would command that, even though our knowledge of disease always proves it.

Therefore, between each hatch sanitary management of every part of the incubator must be practiced. Various machines now on the market have more or less automatic disinfecting features attached to the machines. Others do not, and in these cases the operator must furnish from without the sanitary management required to maintain the machine in a safe condition for use. This work is not difficult or costly, but it must be done regularly and thoroughly. The steps in such sanitary incubator management mainly consist of:

a. Opening up the incubator chambers at the beginning of the season and between hatches, if possible—depending somewhat, of course, upon the type of incubator at hand—, to allow of complete airing, removal of all bad odors and gases, and the drying out of the interior.

b. Brushing out of the chamber, thus removing all bits of shell, down, manure and any other foreign substances which may have accumulated therein. Make this step absolutely complete.

c. Spraying of all interior walls and parts with a warm 5% disinfectant solution, or washing with a hot cleansing liquid.

d. Drying out of chamber, rather slowly and thus giving the disinfectant solution time in which to become more thoroughly effective, before refilling with eggs.

Accompanying any scheme of incubator sanitation must be care in avoiding deliberately introducing Pullorum Disease or other trouble through being indiscriminate in the matter of accepting any and all eggs offered for inclusion within any hatch. So much has been said in the poultry press in recent years about the dangers of incubating eggs from Pullorum-infected flocks that it should be necessary here only to issue the word of warning, and that to the effect that inquiry should always be made concerning this particular disease. If necessary to incubate eggs from known-infected flocks, or even from flocks untested and unknown in this regard, it should be done with caution, and such eggs kept in separate compartments, and never mixed with eggs from disease-free flocks. In such cases interhatch disinfection and sanitary care become extremely necessary.

III. **Special Procedures Concerned With Incubation.**—The egg farmer usually finds that incubation is something more than just the mechanical operation of some given type of incubator, or even something more than furnishing high quality hatching eggs for such incubation. He has to be able to give attention to one or two other problems, such as these:

1. The proper time to remove chicks from incubators. Authorities and experienced chick-raisers differ in their answers to this question as to how long chicks should properly remain within the heated compartments of the incubators. The author's observation and experience points to an advantage in removing chicks soon after they have dried off and are up on their feet, active, and taking

an interest in their surroundings and their companion chicks, which is when the majority of them are approximately 24 hours of age. The older thought that chicks should be at least 48 hours old before they are removed from the incubators and fed is somewhat dissipated in these days. If the chicks are to be transported, they may be removed at this same age of 24 hours, boxed, and shipped.

2. If the egg farmer is following a breed-improvement management program, as has been suggested in previous pages, he will find, sooner or later, that some marking of chicks hatched will be required. The amount will vary with the degree of intensity undertaken in that breeding program.

a. Where no trapnesting is done, but where some effort has been made to select breeding stock and to divide it into breeding flock units, these items in chick-marking should be considered:

1. Every lot of chicks hatched should be marked so as to identify the individuals of that hatch at any later time. Even if broiler production is the only objective some method of keeping accurate record of the ages of each lot of chicks is a necessity. The use of toe-punching, or toe-slitting, as preferred, is suggested for this identification of "hatching date" or "age." For example, all chicks brought out in the first hatch, perhaps, Feb. 1st, might be toe-punched with an outside left, and thus recorded. The second hatch, of Feb. 24 perhaps, might be marked similarly with an inside left, etc. These identifying toe-marks remain always as an index to

age. It enables the egg farmer often to judge between early, medium, and late-maturing individuals of the same age. The record requires no special form upon which to be kept.

Reserve the "outside right toe-mark" for the purpose of marking chicks from "6" size eggs, as before suggested. (See p. 109).

2. In addition to marking each lot of chicks as to age, or date of hatching, it is useful to mark each lot from specific flock matings, so that at least the flock-origin may be known later when selection is done. The numbers of different flocks and of different hatches are not so great, on the average farm, as to exhaust the possibilities of using the toe-markings for both these identification purposes. Of course, if numbers do exceed the possibilities of this toe-marking scheme, wing bands or leg bands may be used and the necessary records kept. It is important, however, that the egg farmer who is carrying forward a breeding improvement program should know, at least, these two things: (a) the date of hatch of every pullet handled in the fall, and (b) the flock of breeders from whence each pullet was produced.

It is obvious that these rules for chick-marking need not necessarily apply to chicks hatched for sale, although customers may some day value that service enough to request it or even demand it. It is possible, of course, for very buyer of chicks to toe-mark the various lots of day-old chicks as he receives them, and even to identify their sources by other toe-marks, if he knows what those sources are.

b. Where trapnesting of individual breeder hens is done and it is essential to maintain the individual identity of each egg, pedigree-hatching is called for:

1. On the 18th day of incubation, remove the eggs from the incubators and, in a warm room, and with warm, clean hands, handle each egg. Place those of the same mark, that is those produced by the same hen, in a separate place. Then place the eggs of similar source in pedigree wire baskets, or pedigree muslin bags, not putting more than four eggs in any one pedigree basket or bag. Mark each basket or bag distinctly, not depending upon the marks on the shells for later identification, for, if all eggs hatch, the shell marks are often obliterated entirely.

2. On the 21st day, or as soon as it is judged that the hatch has been completed, open up the machines and open the pedigree trays or bags, separately and in order, being most careful to preserve identities.

3. Mark each chick with a numbered wing or leg band, and record each chick as to (a) identity of hen from which egg came, (b) number of chick, and (c) date of hatch.

Chick pedigree records need not be cumbersome or laborious to maintain, for the above three items are the essentials and no special form is even demanded.

c. When the chicks are ready to be removed from the incubators to the brooders, care should be taken to prevent chilling. The chicks have been hatched in an environment which is usually between 103° and 105° F. in temperature. They have been accustomed to this fairly high degree of warmth, and to a situation of controlled air and moisture conditions. The conditions to which they are removed directly from the incubators must not be too great and too sudden a change or shock. Chilling at this step may cause trouble later on. It is suggested that

1. Chicks be removed from the incubators by clean warm hands, and transferred to protected basket or box, lined or bedded, so that chances of chilling between incubator and brooder are minimized.

2. Transfer be made quickly, again to cut down on chances of chilling.

3. If chicks are to be transported they should be boxed and covered and placed where they will be protected against either extreme heat or cold. Usually chick boxes are made so as to divide the chicks into 25-chick lots, this making for efficiency and comfort. Follow the directions of the chick-box manufacturers in using their specific boxes.

IV. **Chick Sexing Interests Many Egg Farmers.**—For many years egg farmers have found one of their most difficult problems to be concerned with the handling of the surplus male chicks which they always have on hand.. Nature produces the sexes in chicks in about equal proportions. In egg-type breeds, like the White Leghorn, used so widely in the modern egg farming industry, the economical handling of the surplus males has been a real problem. To be forced to handle such males in some way or another, at least for the first month—at the end of which Leghorn male chicks may be readily identified—has been mandatory on egg farmers. From time to time persons interested primarily in securing a supply of pullet chicks for layer replacement purposes have questioned as to the possibilities of differentiating between the sexes of chicks at the day-old stage. Countless schemes have been proposed, but most of them have not proved scientifically sound and sufficiently dependable to become of commercial value.

In very recent months, two practicable methods of sex-differentiation in day-old chicks have been given to the poultry public.

1. The Japanese Method of Chick Sexing, discovered by Japanese poultry scientists, employs certain differences which have been noted between male and female chicks. This method has created rather a sensation in America where it has been used quite extensively and on reasonably large scale. Readers are referred to the numerous Experiment Station and government bulletins, as well as to several text books, for the details of the Japanese Method of sex differentiation in chicks. The author, jointly with L. M. Black, of the New Jersey Station, published Circular 358 on "The Problem of Distinguishing the Sex of Day-Old Chicks," in June, 1935.

The object of using this method of sex-differentiation is to enable poultrymen to separate the sexes at hatching time, and is predicated upon the supposi tion that there is economic advantage in so doing. For the egg farmer who is producing his own chicks each season this differentiation of the sexes at hatching time is of doubtful economic significance, in the mind of this writer. He is not convinced that the average egg farmer can most economically solve the surplus male problem by killing off (or selling off, if he had customers) the chicks which happened to be males as soon as their identities as such has been determined. If, however, the farmer is purchasing chicks, it may well be of some economic advantage not to have to handle any surplus male chicks. At the same time this practice may build up a special trade for the male chicks, since the producers will have to be able to move them to some economic advantage or else make the sales price of the pullet chicks considerably higher than would otherwise be necessary.

Apparently the investigation of the real value of any such method of sex-differentiation is still in its infancy, and poultrymen must await proofs of its fundamental values. In the meanwhile many will probably become interested in its possibilities.

2. While the author was living in close contact with the British poultry industry in 1925-26 he became interested in the other practicable means of distinguishing the sex of chicks at hatching time, namely "sex-linked inheritance cross-matings." This principle of the inheritance of certain characteristics in close linkage with sex has been known for some time. The author tried out several cross-matings at

the New Jersey Station and reported on them as to their usefulness as means of sex differentiation at hatching time in the Circular 358 above referred to. This scheme involves the use of certain pure breeds or types, in which the female parent of the cross-mating carries the specified sex-linked, dominant characteristic and the male parent is known to be entirely without that characteristic. In each case, where such cross-matings have been properly set up, the resultant male chicks have resembled the female

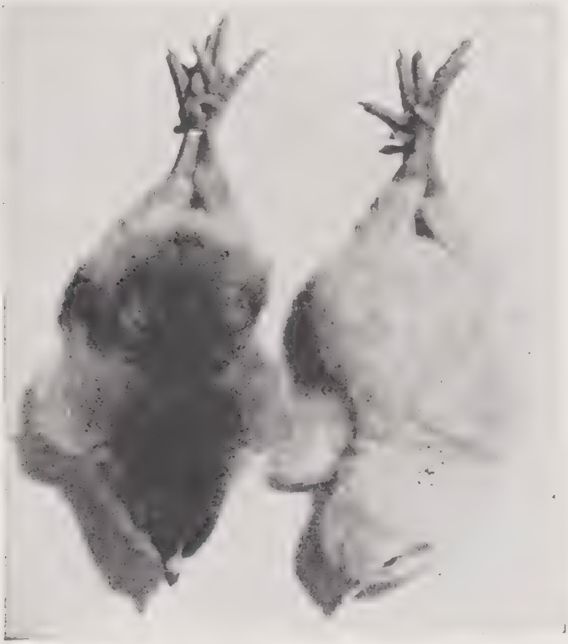


Fig. 34.—The reddish brown, or golden female day-old chick, at left, and the silvery yellow male chick, at right, were readily distinguishable at hatching time. Parents were a R. I. Red cock mated on light Sussex hens.

parent and the female chicks have resembled the male parent. If the characteristic used is distinctly discernible at hatching time, it is evident that such cross-mating will serve as a means of sex-differentiation at the day-old stage.

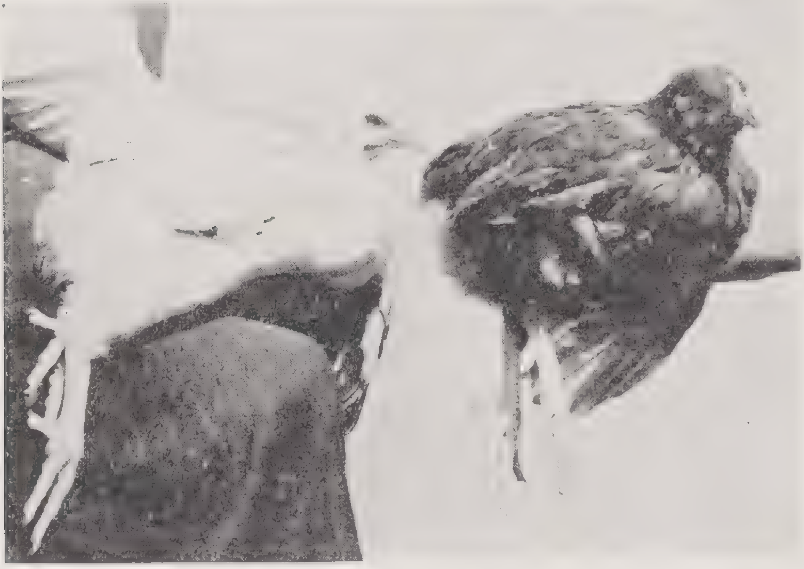


Fig. 35.—The silver male chick of the R. I. Red light Sussex cross-mating, at the half-grown stage, at left, and the sister, golden, at right. The flock of cross-bred pullets proved to be excellent, economical layers.

As reported in the N. J. Station Circular 358, this method was tested:

a. "Golden plumage" males were crossed on "Silver plumage" females—for Punnett and others had reported that the gold-silver pair of characteristics behaved in sex-linked manner. The silver plumage color is dominant to the gold, and is sex-linked. In order to secure the results desired it is always necessary to use a female bearing the dominant character (in this case, silver) and a male of the opposing group (in this case, gold). The chicks of the first generation are divided: the male chicks are invariably silver in down color, and the pullet chicks are in variable golden or reddish brown in down color. The Light Sussex furnished a typical Silver, and the Rhode Island Red a typical Golden. Or, in the egg type class of fowls, the Columbian Leghorn was used as Silver, and the Brown Leghorn as a Golden. The accompanying pictures, by courtesy of the N. J. Station, illustrate these two typical "sex-linked inheritance cross-matings."

b. "Black plumage" males were crossed on "Barred plumage" females in another sex-linked inheritance cross-mating, this time employing the Black-Barred pair of characteristics, in which the barring is dominant over the absence of barring. Barred Plymouth Rocks, in which variety may be found excellently stock, furnished the breeder hens, and Black Minorca males were used for the male side of the matings.

These instances are but a few of the possible cross-matings by means of which chicks, the sex of which is discernible at hatching time, may be produced. Such chicks, like pure bred chicks, will be as economically valuable as the stock whence they sprang. Crossing in itself will not produce good layers out of mediocre parent stock. In the employment of this method of securing sexed chicks it must be borne in mind that it is the first-generation chicks only which will exhibit the sex-signifying down color characteristics. New cross-matings of pure bred male and female lines must be used each year. This method involves no critical examination of the chicks, as is true of the so-called Japanese method. The differences in down color offer the key to separation of male from female.

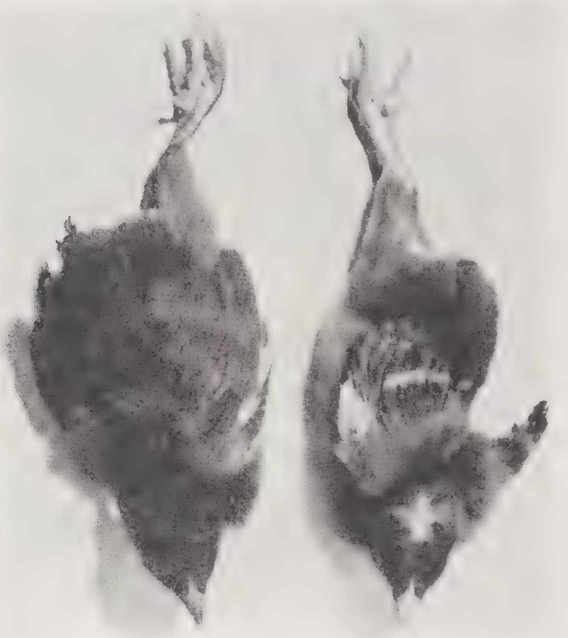


Fig. 36.—At left, the black pullet chick, and at right, the barred male chick from the Black Minorca cock-barred Plymouth Rock hen mating. Note the tell-tale white spot on the back of the head in the barred chick.

A more recent development in this field of poultry breeding has been the perfection of new breeds which are auto-sexed, by down color at hatching time. The author has developed a flock of Legbars at the New Jersey Station; in these the sex of the day-old chicks may be readily distinguished by differences in down color. These Legbars breed true, once established. Whether or not such auto-sexed breeds will ever become competitors of the White Leghorns, the Rocks, the New Hampshires, or the Reds on our large commercial poultry farms can scarcely be predicted at this time.

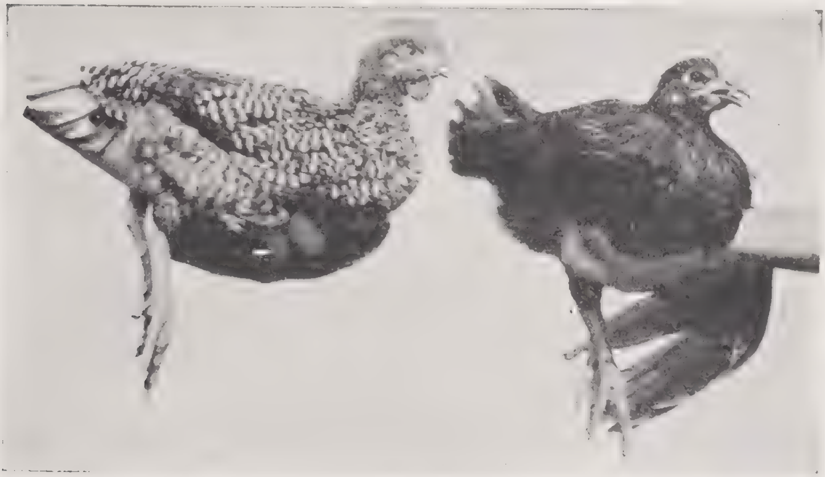


Fig. 37.—The barred male and the black female progeny of the barred-black sex-linked inheritance cross-mating, at half-grown stage.

Hybrid vigor, invariably present in such cross-bred stock, is a factor working toward both better egg yields and better meat production.

V. **A Workable Program of Management of Chicks in Brooder Days.**—There are almost as many satisfactory ways of handling chicks under brooders and of rearing chicks during their first few weeks as there are good poultrymen and egg farmers engaged in the poultry business. There is no "best method of brooding and feeding and caring for baby chicks." The author will attempt to outline below the method which in his observation and experience has proved to be one satisfactory scheme of chick-brooding. He has found that it will work and that it will produce good growth, economically and efficiently, and that it will develop pullet chicks into healthy, strong, vigorous laying stock, other things being equal. The method chosen for presentation in these pages is a composite arrived at after many years of watching and experimentation. It is adapted to small-scale care and management of chicks, or equally may it be used for large-scale operations, such as are called for on the large egg farms of the country. The principal items follow, and are additional to those items which were presented in the last chapter under the discussion of sanitary management:

1. It is assumed that the brooders have been cleaned and made ready for the chicks. They must be started without handicaps in so far as possible. The brooder stoves should have been going steadily

and under perfect regulation for at least 24 hours before the chicks are entrusted to them.

2. Preferably transfer chicks to brooders in late afternoon, so that not very much lighted time remains before they seek their warm resting places for the first night out of the incubators.

3. Erect a circle of inch-mesh poultry netting, or heavy ply-paper, about 18″ high around the outer rim of the brooder hover, placing it about 2′ from the outer edge of the reflector-hover, making a circular space in which the chicks will find warmth and receive their first training in brooding under artificial sources of heat. This circle will profitably be used for the first week or ten days, after which time the chicks should have been so trained as to no longer need its restraining influence. It teaches them to stay near the source of heat and prevents their getting into corners and crowding together for warmth, but thereby crushing many and ruining the health of others.

4. On that first afternoon give the chicks—and the author believes firmly in feeding chicks as soon as convenient after they are 24 hours old——

a. Plenty of sour skimmilk, preferably put before them in earthen ware, or non-metallic, crocks, and protected so that the chicks cannot get into the milk. The vacuum form of drinking fountain is excellent for use with chicks during their first month or so. The author prefers to give young chicks no water, only sour skimmilk, as a beverage during first five to six weeks. At any rate withhold water for a few days until all chicks have definitely learned to drink and like the milk. Sour skimmilk is easily and quickly digested by young chicks and gives them a spurt forward that is difficult to secure otherwise. Keep the sour skimmilk fountains clean, washing thoroughly each morning as fresh milk is furnished.

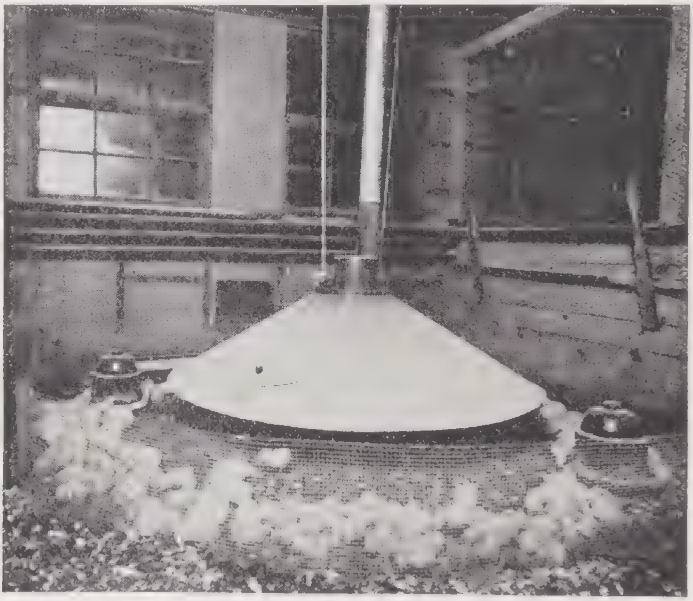


Fig. 38.—A first-night flock of White Leghorn chicks under a Colony Brooder Stove, with conditions all set for optimum brooding results.

b. Some fine cracked chick grain mixture. A home-made mixture of 2 parts, by weight, of fine cracked yellow corn and 1 part of fine cracked wheat. If not prohibitive because of high price, the addition of 1 part of pinhead, or steel-cut oats tends to improve the nutritive quality of the chick grain ration. Feed the amount which the chicks will eat up in about twenty minutes. Spread the grain on papers, egg crate fillers, or wide, flat boards during the first week, after which time it may be fed in low troughs, or scattered in the litter. The author prefers to use the troughs because of the unsanitary nature of the litter after it has been used for chicks a few hours. Keep the feed as clean as possible at all times, constituting one of those little management factors which together with all the others make up a health program in chick rearing, and poultry management generally.

c. The chicks may be fed their first meal of "starter" dry mash that first day under the hovers. It may be fed on papers, fillers, or boards in the same manner as suggested for the grain. After the first few days, low hoppers may be substituted. The author has been concerned with the development of the New Jersey Station poultry rations for many years and therefore it may not be considered strange if his recommendations are similar to the New Jersey rations and methods. The starter mash might consist of some such home-made mixture as the following, the New Jersey Chick Mash (100 lb. mix):

26 pounds yellow corn meal,
15 pounds wheat bran,
15 pounds flour middlings,
10 pounds pinhead oats, or pulverized oats,
5 pounds meat scrap (2½ pounds of meat and 2½ pounds of fish meal may be used if both are the

same in price, and both are approximately at the same protein level),

15 pounds soybean oil meal,

2½ pounds dried buttermilk or dried skimmilk, or whey,

2½ pounds dehydrated alfalfa leaf meal,

1.8 pounds oyster shell meal or high grade, limestone flour (over 90% calcium carbonate),

.2 pound poultry feeding oil (2000A-400D)

½ pound salt, preferably iodized salt (the salt may be omitted if fish meal has been included in the mash) .

This chick starter mash may well be used for the first eight to ten weeks. There are many excellent formulas for chick starter mashes available at various experiment stations. There are many excellent commercial chick starters on the market. The egg farmer must consider price differences, convenience, time used for mixing, etc., in arriving at the decision as to whether to buy commercial mixes or attempt to mix one at home, according to some such formula as the above. The important thing is to get a satisfactory mixture, honestly mixed.

In both chick grain and starter mash mixtures only the highest quality of materials should be used. Molded, musty grains, decayed meals, etc. may upset chicks immediately and cause much trouble.

d. Watch the chicks during the first few nights as dusk falls and see to it that they form the habit of arranging themselves in a ring under the outer rim of the hover, thus exhibiting comfort, as to temperature supplied.

5. Chicks may be given green food at any time after the first day. This may consist of cut fresh juicy succulent leaf growth, such as new oats, alfalfa, or grass sprouts. Or sprouted oats may be used, preferably after the sprouts have attained three or four inches in length and have definite green leafy parts.

6. Usually it is preferable to allow chicks out of doors as soon as conditions permit after they are about ten days old.

7. During the first eight or ten weeks every effort should be made to get the chicks to consume at least twice as much grain as mash.

8. Small size grit should be kept before the growing flocks at all times after the first week, preferably in low hoppers.

9. Throughout the brooder season, and during the range period too, for that matter, ample grain and mash hopper space must be provided to make it possible for all the chicks to eat at the same time, if they so desire. A common criticism on many poultry farms is a lack of sufficient food containers, and a lack of appreciation of the fast-increasing needs of growing poultry flocks.

10. If the pullets (and cockerels being reared to adult stage) are to be reared in close confinement, the chick starter mash may be continued throughout the growing season, but the proportion of mash and grain consumed should be about equal parts after the 8th week in this case.

11. Where the young stock is to be reared on

range, and green food is available on that range or field, the following economical mash mixture may be substituted after about the tenth week:

380 pounds yellow cornmeal,
100 pounds wheat bran,
100 pounds wheat middlings,
100 pounds heavy oats (ground),
150 pounds soybean oil meal,
75 pounds meat scraps (50% protein),
50 pounds alfalfa leaf meal,
10 pounds iodized salt,
20 pounds limestone with manganese,
Supplement with a grain mixture of
100 pounds cracked yellow corn,
100 pounds whole wheat.

On range try to get the pullets to eat about twice

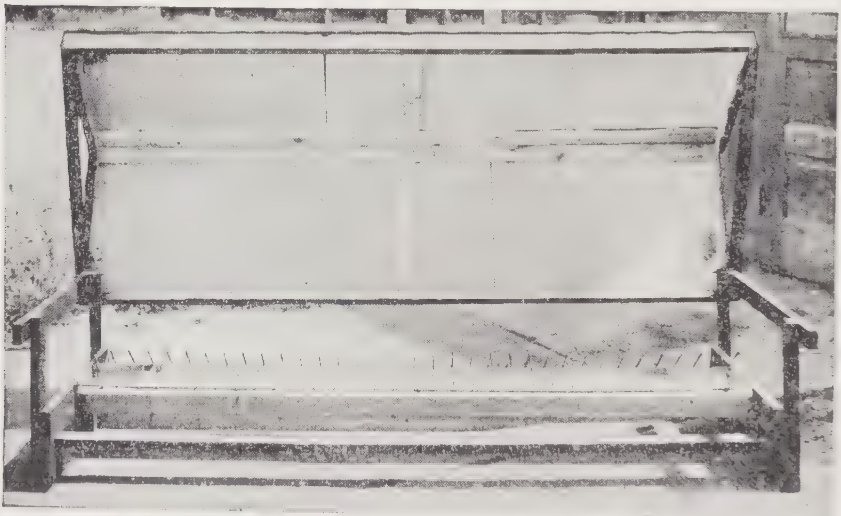


Fig. 39.—Some easily filled and readily accessible out of door mash hopper as well as one for grain feeding is necessary on every poultry young stock range.

as much grain as mash. Grain feedings should be divided into about three for each day, with heaviest grain feeding in the morning.

VI. **Practice Culling for Quality Throughout the Season.**—The egg farmer cannot afford to spend time or money on poor, weak quality chicks or pullets or cockerels. He should watch the growing flocks daily throughout the summer season, culling poor specimens as soon as they are seen. Do not feed poor chances.

VII. **Many an egg farmer may have some surplus of pullets for sale,** for one reason or another. He may turn over some of that surplus number in mid-season, at twelve to fourteen weeks of age, as "squab pullets," birds no longer needing artificial heat, and which have been weaned from brooder house conditions and are ready to go on through the remainder of the season in simple colony houses or range shelters. Some of the surplus pullets may be kept to the 22 to 24-weeks-old stage, when they are approximately ready to lay.

VIII. **Finishing Pullets as They Reach Laying Maturity.**—Leghorn pullets should be nearing laying maturity from the twentieth week on, and the heavier breed type pullets will require an additional four to eight weeks for similar development. Every pullet should come into egg laying maturity in "the pink of condition," that is in good flesh, perfect health, robust body strength, active, vigorous, alert and with some reserve of body fat with which to begin the year of being forced for heavy egg yield.

The farmer should see to it that during the last few weeks on range the grain consumption is kept up so that this reserve of fat and good flesh condition may be insured.

If chicks are hatched, brooded, and reared under some scheme of management which will insure their normal, natural growth and development throughout their first summer and accomplish this at economical rate of cost, much of the success of the following year's business is guaranteed. The author would urge that every egg farmer consider most carefully this whole matter of "pullet, or layer replacement," not only from the point of view of breeding, but also from the point of view of actual costs. It is imperative that replacement layers be raised and made ready for the laying quarters in the fall at as low costs as may be commensurate with high quality and healthful development. It makes a vast amount of difference to the egg farmer whether his replacement layers go into laying quarters having cost something like $.75 each or something like $1.50 each, and both of these figures have been seen on nearby plants during the past season. For general purposes of estimate, it is suggested that the average egg farmer may reasonably figure on his replacement pullets costing him approximately $1.25 each to rear to the ready-to-lay stage. If, under his individual conditions, they can be put into laying quarters at a figure under $1.00, so much the better!

Under average conditions it is suggested that the following figures may be found useful for purposes of estimating or planning the year-program:

IX. **Estimating Pullet or Layer Replacement Needs.**—Based on several years of observation of many egg farms, it is suggested that:

1. Approximately 75% of eggs gathered from breeding hens are of a quality worthy of use in incubation.

2. The average yearling, or older, breeder hen should lay approximately 45 to 50 eggs during the average hatching-egg season—January through April—, and of these from 35 to 40 should be of incubation quality.

3. Under average seasonal conditions an average hatch of about 70% may reasonably be expected, thus producing about 25 good chicks from each selected breeder hen for the season. Of course, it will be appreciated that many hens may yield double this number, but it must also be recognized that others will not make the average. To figure on getting an average of 25 chicks from each selected breeder hen is safe as a basis for estimates, or should be in any average year.

4. Again, under average conditions a mortality of 15% for the brooding and rearing season may be expected, and thus the 25 chicks may be reduced to approximately 20.

5. Half of each chick flock will be males. Thus it is that the egg farmer must figure on securing not more than about ten good replacement layers, that

is pullets, from each selected breeder hen used in his breeding flocks.

6. It usually costs approximately three cents per egg to meet all actual costs of incubation. This may be high for some situations and low for others.

The author believes that every egg farmer, irrespective of the methods through which he secures his new pullet egg-production flocks each season, should keep such records as will enable him to know with a reasonable degree of certainty what such replacement layers have cost up to the point of their being placed in permanent laying quarters in the fall of the year. The keeping of all items for a season will often result in one's being able to find the weak or costlier points in the replacement program and thus make corrections and improvements in future hatching, brooding, and rearing management.

VI

THE ECONOMICAL AND EFFICIENT HOUSING OF YOUNG AND ADULT POULTRY

A MARKED tendency in recent years in the management of fowls for table egg production has been to increasingly confine them within the limits of the laying quarters, that is to intensify the use of the buildings or houses provided as an environment for them. The same tendency has, on the other hand, decreased, relatively speaking, the use of yards and ranges for adult stock, especially during the first laying year. Such changes in management practice have not happened haphazardly, but are undoubtedly due to more or less sound interpretations of experience. The trend has definitely increased the emphasis which must be placed upon the housing of poultry. If egg farmers are to look upon their fowls as "units of production capacity," as has been suggested in these pages, they may, then, with equal propriety, consider the poultry houses as the "factories" in which those producing units are to be managed or handled. Because the producing units, in the poultry industry, are living things and, as such, are directly affected by factors of immediate environment the "factory building" in egg farming becomes a matter of greatest economic significance. It must be made to serve the health and productive tendencies of the fowls confined therein efficiently and economically. Proper housing can be and must be made to (a) aid in the building up and maintaining of the normal, natural health of the fowls, and to (b) induce, along with other factors brought to bear, a rate of growth, egg yield, or meat production—as the case may be—which will have in it potential possibilities of profit.

Something of a key as to why greater emphasis is being placed upon the proper housing of poultry, both young and old, but, perhaps, especially upon laying stock, in these days may be found in a brief examination of some of the reasons why poultrymen are now practicing closer confinement of poultry stock to buildings than was true in former years:

1. The tremendous development of the modern poultry industry and its widespread growth throughout every section of the country has been accompanied by an increase in the incidence or occurrence of poultry diseases, ailments, and parasites. Such a coincident event has been a natural circumstance, and practically unavoidable. Its presence, however, must be admitted and reckoned with. Such an increase in poultry population and corresponding increase in factors affecting the health of fowls have necessitated taking steps in commercial flock management which might tend to counteract that situation. It has become necessary to surround fowls with an environment which could be gotten

under and maintained under a greater degree of sanitary control than was formerly demanded. It has been common experience that poultry houses or buildings, as environs of poultry, could be thus more efficiently and economically controlled, as to sanitation, than could the soil of yards and ranges. In the first place, then, it has been a need for a more satisfactory and effective sanitary scheme of management which has forced many poultrymen, and the industry generally, to turn to poultry housing as one means of solving poultry health and disease problems. Whether or not such practice has always worked out toward that end as satisfactorily as might have been hoped, and whether or not the older and more extensive method of poultry management, involving greater use of the land, has been properly charged with being unsanitary, the industry, as a whole, has gone steadily on toward an increasing tendency toward leaning upon housing as a method of health preservation and disease control.

2. Under present day economic conditions, feed costs, labor expense, etc., it is absolutely essential that egg farmers using stimulating or forcing methods of management in an effort to secure sufficient growth or egg and meat yields to render profit possible. It has been found usually that a closer confinement of fowls to houses is conducive to quicker results. The fowls are kept closer to their feed hoppers. Increased food consumption is enhanced. They waste less time than when allowed access to yards or fields. There is, undoubtedly, much to this

argument. It is logical to consider that the more constantly one can keep fowls at the business of food consumption and engaged in activities resulting in products for which they are being kept the more probable will be an increased rate of such production and the greater will be the chances of a margin of profit in the undertaking.

3. Egg farming has been developed on many locations or in many places wherein sufficient land area has not been available for the development of the enterprise along extensive lines or according to schemes involving considerable range or yard area. Limited land for the use of the poultry flocks, then, has also been a factor. Men and women, interested in using poultry as a means of livelihood, have often been confronted by a very limited land area supply. It has been a question of refraining from venturing into poultry keeping entirely or attempting to do it along more intensive lines, using less land and depending to a greatly increased extent upon buildings. Experience has proved that such an alternative was possible of economical results; poultry production can be brought about, with efficiency and profit, through intensive methods of management. Egg farms have been developed on locations where the acreage of land was limited and did not permit of the use of the older schemes of yarding and range management. This trend has sometimes been a matter of choice, and at other times not so. The discovery that poultry and egg farming might be economically practiced under conditions of decreased

nomical production. In recent years experience has determined that, from the standpoint of original capital investment, the needs of the egg production plant may be most economically met through the employment of more housing space and less land area, that is that each dollar invested in housing could be made to yield greater returns than each dollar invested in land. Therefore, there has been a natural tendency to turn toward that system which required the lower capital investment, figured on a per-bird basis, or upon the basis of the actual costs of products yielded. Conditions differ widely in different localities. In many places the land still is available and is so priced as to make the extensive scheme of poultry flock management an economically favorable method. In areas in which egg farm-

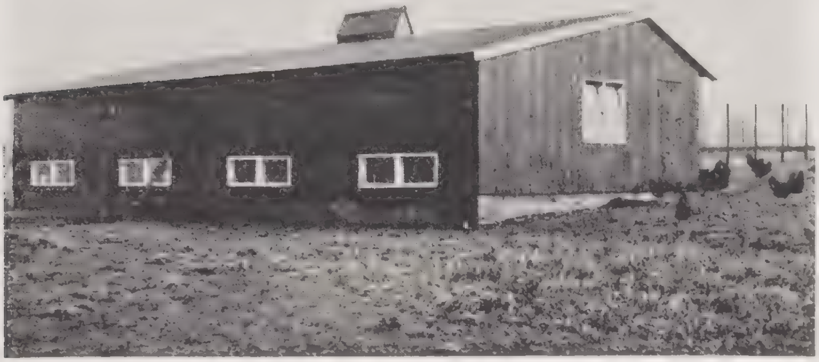


Fig. 42.—A flock of R. I. Red layers managed under a yarding system on a farm where acres are available.

ing has reached commercially significant proportions, however, land areas have tended to rise to high levels, and even in instances to be so limited in availability, as to add to the modern trend toward an increased dependence upon housing in poultry management.

I. The Principles of Poultry Housing.—Whether the poultry house is to be used for chicks, growing pullets, layers, or breeding stock matters little. Whatever the purpose for which it is used, the fundamental principles upon which every poultry house should be planned and built are similar. There is "no best type of poultry house." There are infinite varieties of satisfactory poultry houses, just as it was suggested that there were infinite good ways of chick feeding. But, if any certain type or plan of poultry house is to be found economically useful in modern egg farming, it must include within itself certain essential features, which might be stated somewhat as follows:

1. *Protection.*—Every poultry building is primarily used as a means of protecting the fowls, of whatever age, contained and managed therein against (a) the elements—all weather and climatic conditions and changes thereof, (b) thieves, and (c) the various factors which tend to destroy health. The house must be so planned and constructed that it will afford these forms of protection, and accomplish such protection at least possible expense.

2. *Comfort.*—The modern egg farmer realizes that he must provide a comfortable environment for his

hens, and also for his chicks and growing stock. They will grow best and produce best only when they are comfortable, not suffering from chill drafts, or wet, damp floors, or other uncomfortable environmental conditions. To provide a comfortable surrounding for fowls is the same thing as providing an environment which will tend to induce normal, natural activities among them, these resulting in improved health and greater yields. As the scheme of management becomes more and more intensive in character, as fowls are being kept in close confinement to buildings and therefore in closer contacts with each other, and as they are being managed in ways which make them more and more dependent upon the buildings in which they are being kept, an increased degree of attention may well be turned toward this matter of insuring the comfort of the poultry flocks. This is not to be construed as arguing in favor of luxurious comforts, but simply for an environment which will help to bring out the best inherent tendencies of the birds. Hens will rarely continue as good eaters and good egg producers under an environment which forces them to seek the perches to get away from chill floor drafts, or to stand about in inactive posture because of cold, damp, disagreeable air conditions within the laying house.

3. *Temperature or Heat.*—There is, in the opinion of the writer, no one more important feature of modern poultry housing than that of supplying a sufficient degree of temperature to keep the fowls

in comfort and to encourage optimum activity among them. Fowls are small bodies and, as such, may be relatively quickly affected by a lack of heat in their environment. Fowls have relatively high body temperatures, approximately 105° to 107° F. If cold temperatures in their surroundings force it, fowls must use comparatively large amounts of food for energy and heat production, and correspondingly less, therefore, for growth, meat, or egg production. It is uneconomical for poultrymen to attempt to keep their fowls in normal condition by feeding. It is rather more economical to surround them with temperature conditions which will allow a maximum usage of food consumed for the purposes of growth, meat, or egg production, as the case may be. A proper degree of temperature is conducive to optimum activity among fowls of all ages, and therefore temperature becomes at once a direct factor in securing adequate and desired food consumption and general productive behavior on the part of the fowls. Given a comfortable environment, in so far as temperature is concerned, there may be considerable fluctuation as to some of the other essential features, such as ventilation or moisture, without dangerous consequences. The modern poultry house must furnish adequate temperature conditions, if it is to best serve the business of egg farming.

The necessary degree of temperature for optimum results in the poultry house is impossible to lay down in the form of a definite rule, because so many and such varying circumstances, obviously, enter into that proposition. Again, the comfort of the fowls must be relied upon as the principal guide. It is, of course, in the two seasons of extremes in temperature, winter and summer, that the problem of temperature control in poultry houses arises. In average days this matter takes care of itself in anything like a well-built poultry house. The satisfactory type of poultry house, therefore, should be planned and built so as to furnish a suitable environment for fowls during the days and nights of both extremely cold and extremely hot weather and be easily and economically adjustable to the average days in the in-between times.

There may be one or more of *four principal means of insuring adequate poultry house temperatures* employed in any given type of house:

a. The use of materials, particularly for wall and roof construction, which are in themselves protective in this matter of temperatures within the poultry house, does much in solving this problem. The materials selected should permit of tight, sound construction; they should be insulative in character; and they should tend to hold conditions without too great response to sudden changes in outside temperature conditions. In attempting to keep costs of poultry house construction to a minimum the use of building materials which render those buildings difficult to handle from the standpoint of maintaining desirable temperature conditions within them has sometimes occurred.

b. The proper designing and construction of any poultry house, irrespective of materials used to a certain extent, may be made to do much toward insuring the required temperature provision and control. No possibilities for (a) drafts because of cracks, crevices, or breaks in wall or roof construction, or (b) for long sweeps of unbroken floor drafts within houses should exist. If the house has been well designed and tightly built and durably put together, it should conserve temperatures during cold weather and insulate against extreme heat in summer time.

c. The principle of insulation of poultry houses has received considerable attention in recent years, meaning by the term the employment of building materials and construction designs which will definitely (a) protect the interior of the poultry house against sudden changes outside of it, through use of means which tend to insure slow response to temperature changes, and (b) conserve established temperature conditions. At times this means the use of wall and roof materials of proved insulation value, such as especially thick boarding, materials of commercial insulation type, hollow tile or cement blocks, and asbestos preparations. At other times this means the employment of doubled wall or roof construction, by use of insulating materials as linings for the houses. The use of the principle of insulation of poultry houses has been advocated by the author in his work at the New Jersey Station for several years, whenever either winter or summer

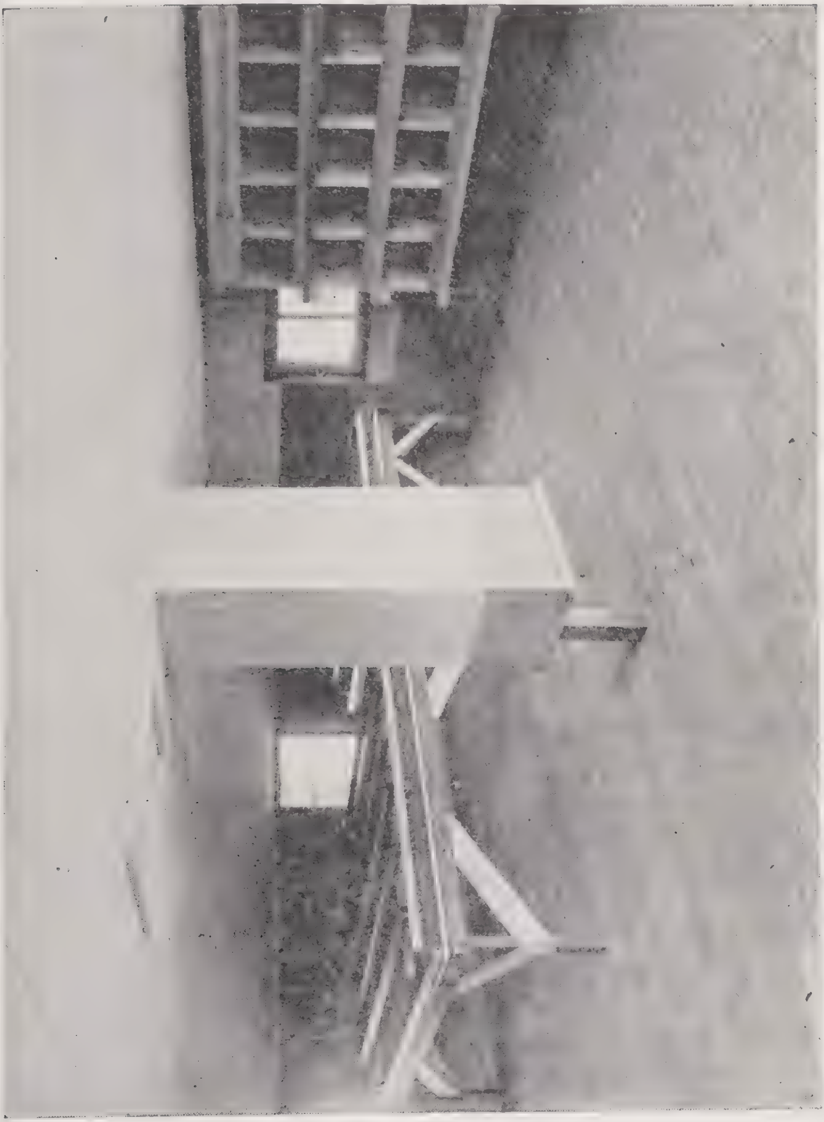


Fig. 43.—The interior of the New Jersey Multiple Unit Poultry Laying House, showing the employment of insulation wall and ceiling boards.

climatic or weather conditions were apt to be such as to include extremes in temperatures and sudden and radical changes. Properly applied, insulating materials should protect poultry houses against the outside cold of winter seasons and likewise against the hot rays of the summer sun, and especially should they bring about gradual changes in temperature within the houses even though outside conditions may have changed suddenly and in extreme manner. The use of the principle of insulation of poultry houses is advocated, if it is desired that the poultry confined within the houses should be surrounded with as nearly uniform, even environmental conditions as may be possible at all times. The author subscribes emphatically to that feature of poultry housing. For continuous, uninterrupted production results it is imperative that poultry flocks be so protected as not to be subjected to the sudden and abrupt weather changes, especially of the winter season. In unprotected poultry houses there is invariably a direct correlation between the sudden and acute changes in outside temperatures and drops in egg yields. In the better constructed, insulated houses the tendency is for egg yields to be less affected by those same outside climatic changes, because interior temperatures have been toned down and the changes lessened in amount as well as in rate of occurrence.

d. In some areas of extreme cold during the winter season the use of artificial heat in poultry houses is certain to prove economical and productive of increased egg yields. If the use of the above three principles of temperature protection prove not to be sufficient to protect fowls against extreme cold occurring in the given locality, no hesitancy should be felt about installing some form of artificial heat. It is probable that in the future more rather than less of the laying houses on egg farms will have some sort of artificial heat supplied for winter use. It is during the winter months that highest egg prices usually prevail. It is then that the poultryman can least afford to suffer a drop in egg yield due to sudden and serious drops in outside temperatures which have been immediately reflected within the poultry houses and have contributed to sudden drops in egg production. Usually artificial heating has only to furnish sufficient heat to protect against freezing. In a poultry house of heated type in a recent winter the average temperature was approximately 50° F., at which the layers continued evenly day after day in the performance of their normal activities and productivities.

4. *Ventilation.*—The poultry house must be as thickly populated as possible in order to lessen the charge per bird for housing investment. It has already been said that the average commercial laying flock unit ranges from 100 to 125 layers. Hens require a comparatively large amount of fresh air, that is oxygen. Hens are so constructed, anatomically and physiologically, that their expiring breaths are unusually laden with impurities and waste products of the body processes. Hens do not have sweat

glands. The body wastes which are given off through perspiration in human beings are removed largely through the respiratory systems of fowls. The greater part of the impurities removed from the system by the kidneys of fowls are given off through the respiratory system rather than in liquid form. It is unusually necessary, therefore, that the environment in which poultry is kept closely housed should be constantly ventilated. This must be accomplished without the creation of uncomfortable floor drafts. Fowls cannot long remain in health, if required to be subjected to drafts of cold air when at work on the floor or at rest on the perches at night.

There are many schemes of poultry house ventilation which have been tried. There is little unanimity of opinion as to which is best. In general use there are two fundamental types of poultry house ventilation in use:

a. The controlled system of ventilation, employing a closed house, with measured and controlled in-takes and out-lets of air. This scheme of ventilation has been widely used in poultry housing, and with considerable success where it has been followed according to instructions.

b. The open-front system of ventilation, wherein wide openings allow an abundance of in-take, unmeasured and only under general control, and usually accompanied by some sort of outlet flue. In Figure 43 the centrally located ventilating shaft is shown. This, together with the openable front, shown in Figure 44, constitutes a simple, yet thoroughly workable scheme of providing fresh air and removal of used and poison-laden air.

Ventilation must not only furnish fresh air, oxygen, and remove bad air from poultry houses, but it must become one of the chief factors in maintaining a certain desirable degree of freedom from moisture, or dryness, in that house. For reasons above hinted at the atmosphere of the average poultry house, especially during the confinement of the winter season, is apt to become very moist. Excess moisture tends to condense on the cold surfaces within the house, and on the litter, causing unsanitary and uncomfortable environmental conditions. Properly handled, ventilation should be a directly useful factor in the maintenance of dry poultry houses.

The ventilation of a poultry house need neither be violent or excessive. The average poultry house has to be built many times as large, from the standpoint of height and cubic feet contained, as is required by the birds—man wants to be convenienced in his work in that house, and must be. Moderate ventilation usually will suffice.

In the writer's experience the required ventilation is not difficult to obtain in poultry houses of simple design. It does require daily adjustment of curtains and windows, but the flock needs daily watching and certain changes in management because weather and climatic conditions can never be depended upon to remain in anything like regularity. The New

Jersey Multiple Unit Laying House, as shown in the accompanying illustrations, and which the author had some definite part in designing, provides a simple and easily worked method of ventilation.

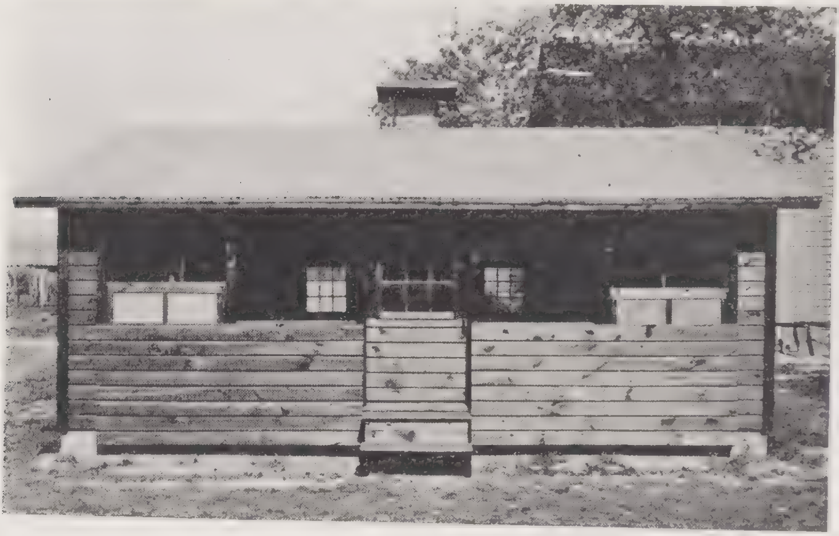


Fig. 44.—A straight front view of the New Jersey Multiple Unit Poultry Laying House, showing the openable front and window arrangement and construction—each unit 20′ x 24′. A durable home for 125 layers or breeders.

5. *Durability.*—The egg farmer or poultryman is not in business for but a few months, unless things go wrong. He is in a continuing enterprise. He has to plan on a long-time program of work. His poultry buildings must be durable, otherwise the items of repair and replacement become too heavy a toll against any year's business. A poorly constructed poultry house, made of cheap and low grade materials, usually has a short life and its upkeep

is expensive. A durable, well-constructed poultry house, however, made of good grade materials is liable to remain usable over a comparatively long life and to require a minimum of annual repairs. This house may be somewhat more expensive in original cost, but annual repairs are less, depreciation less, and ultimate replacement shoved far down into the future. The laying house shown in these pages is one of very durable type. It should have a life in excess of twenty-five years. The cost of original construction is rather high, admittedly, but the cost of annual repairs is reduced and the rate of depreciation is low.

6. *Convenience.*—The modern poultry house must be so designed and built as to serve the convenience of both the hen and the man. As far as the hen is concerned, the house should provide an ample and uncluttered floor area, for that is her working territory, well-lighted and well-littered. The hen also needs a convenient arrangement of nests, food hoppers or troughs, water fountains, perches and droppings-boards, the poultry house equipment which is furnished in order to stimulate the fowls into normal, natural activities and egg yields. If the house is not so planned as to place these items of equipment in such way as to make them useful to all the fowls contained in that house, the house fails as an environment which will stimulate production and earn profits. From the man's point of view, the house must be so arranged as to facilitate and speed up the work which he has to

do each day in the care and management of the hens in that house. A great deal may be done toward minimizing labor required through convenient arrangement of poultry house equipment and through original design of the house itself. The height of the poultry house is usually dictated by man's, not the hen's, height. Man's convenience is sometimes given too much preference over the hen's. The poultry house, by its very design and arrangement, must keep the hens in comfort and induce them to eat food, act normally, and produce eggs at a stimulated rate of yield.

7. *Light.*—The poultry house must be sufficiently lighted as to induce optimum activity among the fowls contained therein. No more light than that is necessary. The usual practice is to face the house preferably toward a southern exposure, or southeast, in order to have a maximum amount of winter sun entering the front elevation of that house. The greater percentage of window space is usually placed in the front wall area. If the sun's rays are depended upon for the anti-rachitic, or Ultra-violet qualities, which it possesses, this exposure is of importance. If, however, the ration has been supplemented by Vitamin-D-bearing foodstuffs, such as cod-liver oil, etc., the subjection of poultry confined within a given poultry house to the direct rays of the sun may not have the same significance which was at one time attached to it. The window space designed for the poultry house, however, should guarantee an even and uniform lighting of the entire interior,

particularly all of the used floor space. A workable rule might be to allow 1 sq. ft. of glass window space to each 20 sq. ft. of floor area, and approximately as much open window, or muslin curtain allowance as there is glass. The glass window space should be divided between front and rear walls in about the proportions of 3 sq. ft. in the front wall to 1 sq. ft. in the rear wall. In the single units which permit of having some window space in the side walls that allowance may be subtracted from the front wall window allowance. The New Jersey house, as shown in Figure 45, has the window allowance worked out in about these proportions. It has, however, treated the front wall windows in a somewhat unusual manner, in that they move up and

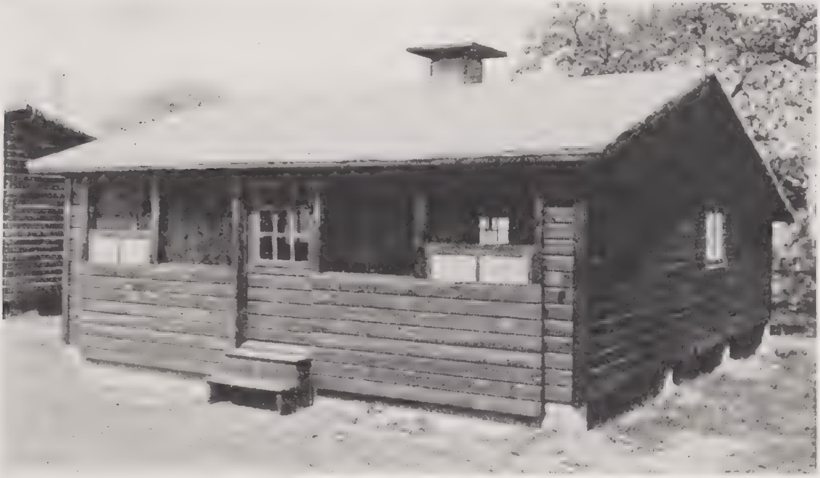


Fig. 45.—A view of a 20′ x 24′ unit of the New Jersey Multiple Unit Poultry Laying House, indicating window arrangement, and the location of the entrance door.

down in a grove, and when the open front is desired the windows slide down into the pocket built onto the front of the house. These windows may be regulation sash and glass type, or mere frames on which muslin has been tacked, as shown in the picture.

There are three principal ways of securing adequate lighting for the modern poultry house, alike for chicks and adult fowls:

a. The building of sufficient window space into the wall areas, and the employment of windows which will admit light and remain efficient in that regard, given ordinary care and management.

b. The use of a light-colored wall and ceiling paint, in order to secure reflection of light and to enhance general illumination through the whole house. The author has believed for many years that greater activity and consequently greater egg yields have been secured in poultry houses wherein the interiors had been whitened or brightened so as to bring about better general illumination within the house. For this purpose any one of several means might be employed:

1. White-wash, that is some lime mixture, applied with a force spray pump, evenly and neatly over the whole interior wall and ceiling surface. This has to be done each fall. It is a desirable step in the sanitary preparation of the house for incoming laying flocks. It is relatively cheap to do.

2. Some white, or light-colored, water paint, of which there are many on the market. Some of them

contain pine derivative disinfectant agencies, which are helpful in obtaining better sanitation. These water paints may be sprayed or painted.

3. Regulation paint, which is more costly, but lasts much longer. This latter is often used on insulated interiors, both for the lighting effect and as a preventive of fowls attempting to pick at the insulation materials used.

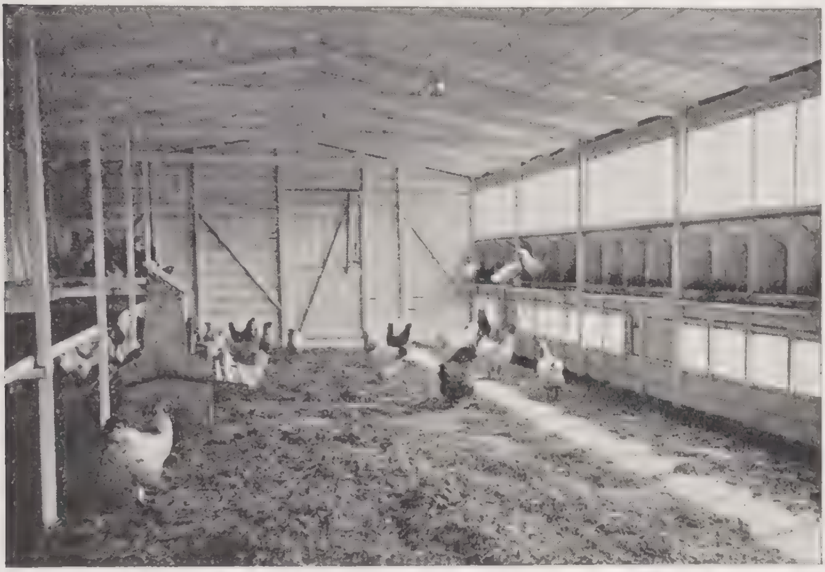


Fig. 46.—The interior of this portable poultry laying house, in England, brightened by use of a white water-paint, ample windows, and not too great depth, bespoke a sanitary environment. Used by the author, in England, 1924-26.

8. *Roominess.*—The primary purpose, after all, in the providing of a poultry house is to furnish a suitable environment for the fowls. It is to assist in the building up and the maintaining of their

health and productive activities. It is primarily to be planned and built to meet the needs of those fowls. Its spaces should, therefore, be arranged primarily to meet the needs of the fowls. There are few rules which are needed in order to accomplish this end:

a. Free the floor space of fixtures and fixed parts so that the fowls have the entire floor area in which to move and work. The nests, perches, water and feed troughs or hoppers, and all other essential equipment may and should be located up off the floor so that the entire floor space is made available for the birds, and in so doing it is usually easy to locate those fixtures in the more desirable places anyway.

b. See that every square foot of floor area is well lighted and made available in every way for the sanitary use of the fowls.

c. Allow a full three square feet of floor area for each adult fowl confined in laying and breeding quarters, figured at the beginning of the season, in late fall.

9. *Economy of Design and Construction Type.*—The nearer square one builds a poultry house or unit the more economical will it be in initial cost, as a rule. This principle has been employed in the designing of the multiple-unit type of laying house. The addition of further units, as the plant grows, is made cheaper through the use of the multiple-unit idea. The poultry laying house illustrated in this chapter, as well as the two-story house also

shown, employ this fundamental principle of plan. Straight lines, few angles, and a minimum of cubby holes or out-of-the-way places which are built in to a poultry house all tend to keep construction costs to a low figure.

10. *Attractive Appearance.*—A business is usually judged very severely by passersby as to the appearance of its buildings and equipment. This is true of poultry keeping. Good looking buildings are in themselves good advertisements, and tend to attract customers. There is another aspect of appearance which is important, and that is the favorable psychological effect which neat, attractive poultry buildings and equipment invariably have on those who work on the plant and upon the owner. It is fortunate that in order to accomplish the other nine essential features of good poultry housing it is usually automatically a means of building neatness and attractiveness into the structures.

II. **Fundamental Types of Poultry House Construction.**—For the purposes of this practical discussion of modern poultry housing, it is necessary only to present those fundamental type variations which are to be seen in wide practice and which have been proved of sound economic value. The writer believes that, all things considered, the principal variations in poultry building types may be summarized as follows:

1. *As to Roof Type.*—There are two points of view from which poultry house roofs may be dis-

cussed; one deals with shape, and the other with materials.

a. Style, or roof design. The writer has found that for the average poultry house, it is a matter largely of personal choice between the

1. Shed roof type, which is constituted of one slant, or pitch, with the low wall to the rear and the high wall to the front. This type of roof is simplest to construct, and is usually cheapest. It can be used on any poultry building which is not more than about 20 feet in depth, and is particularly to be recommended, if for any reason, it is desired to have somewhat greater head room toward the front of the poultry house.

2. Broken-span type, which is shown clearly in the accompanying pictures of the New Jersey Multiple-Unit Poultry Laying House, and which is adaptable to houses of widely varying depths.

2. *As to Roofing Materials.*—The roof of the poultry house becomes a factor of extreme importance in these days of utmost possible use of the houses as a constant environ for poultry. It is a chief protection against the summer's hot sun and equally a protection against the snows, winds, rains, and cold of the winter season. The roofing materials should possess the following minimum of qualities:

a. Insulation value and efficiency, in order to keep out as much heat as possible during the summer and retain as much heat as possible during the winter. The usual types of poultry house roofing materials are not efficient as insulating materials.

Consideration of this point must be given by egg farmers, if they would invest wisely economically in building future poultry buildings.

b. Definite capacity to reflect rather than absorb the rays of the sun. Usually black materials have been used and they invariably draw or absorb heat rays. White, or silver, roof materials would, other things being equal, be much cooler in summer, and as warm in the winter.

c. Tough and resistant against weathering. The frequent replacement of usual roofing materials becomes a severe drain upon the overhead costs of the plant.

d. As low cost as may be possible, consistent with the securing of the other qualities which are necessary.

There are many types of roofing materials which will satisfy these four essentials, but, in order to offer some concrete suggestion in this place, the writer suggests that a roof with the following specifications might be one way of fulfilling these requirements: Use 2″ x 4″ roof rafters, two feet center to center, as the roof framework. Over this nail tightly in place ordinary roofers of good grade lumber, although an expensive grade is not necessary. Cover the roofers with a high-grade of three-ply roofing paper, applied lengthwise of the building and with a liberal lapping at seams. Treat the seams liberally with a roofing cement. Use broad-headed roofing nails, spacing at approximately two-inch intervals. Many poultry house roofs fail because they were not adequately laid originally. Finally paint the roof annually, each fall or spring—preferably the latter, since it precedes the hot summer season—, with some durable but not expensive silver, aluminum, or white paint, to deflect the sun's rays.

3. *As to Floor Type and Material.*—There are three principal types of poultry house flooring in general use. Any one of them will be satisfactory in so far as it, under the given circumstances, embraces the following characteristics:

a. Capacity of being maintained in sanitary condition at reasonably low cost of management. It is essential that every poultry house floor, since it is constantly that part of the house with which the fowls are in closest contact, should be kept in healthful, clean, and sanitary condition, in so far as it is practicable to do so, at all times.

b. Easy to clean, and protective of the litter, thus minimizing the cost and labor of handling the litter problem.

c. Durable, not necessitating frequent replacement; and not requiring frequent replenishing or repairing.

d. Warm, protecting the health and adding to the comfort and therefore to the activity and productivity of the fowls being kept. This does not intimate that the floors should themselves be actually warm, but it does suggest that they must, preferably, not be too cold, or conducive to discomfort of the birds.

e. Dry, or free from constant excess of moisture, since floor moisture immediately increases the cost and labor of handling the litter, becomes a most unsanitary and unsafe environment for the fowls, and works directly against the normal health of poultry flocks, young and old.

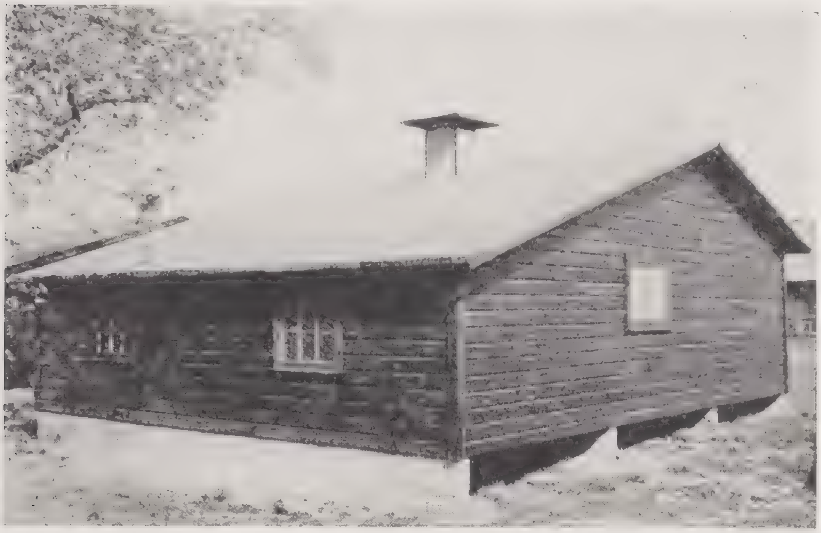


Fig. 47.—The New Jersey house, from the rear, showing rear window location, and roof type, as well as type of foundation wall used.

The three materials usually employed in usual-run poultry houses are:

a. *Concrete.*—The greatly increased use of concrete floor construction in poultry house building in recent years and the preponderance of satisfaction reported in such use testifies to the adequacy with which a properly constructed concrete floor may meet the minimum of essentials for an efficient poultry house floor material. It must be laid properly, in order that it may not be moist, due to capillarity, of course. Drainage of soil and surface water must always be away from and not toward the foundations of every poultry house, irrespective of floor material type used. But if concrete is to be used this precaution is doubly necessary. The concrete floor must be well founded on a tamped cinder or coarse gravel or stone base, and then the concrete floor properly laid over that base. Concrete is durable, easy to clean, disinfect, and manage, and may be both dry and warm.

b. *Wooden.*—The writer has usually preferred the double wooden floor, raised off the ground, built on foundation walls, somewhat as indicated in the pictures of the 20′ x 24′ N.J. Laying House shown herewith. The cost of such wooden construction is usually about the same as that of the well-laid concrete floor. The wooden floor, properly made, furnishes the same essential qualities as does the concrete floor and much the same degree.

In most localities choice between the concrete and the wooden floors will lie (a) in price or cost differentials, and (b) in personal preferences of the owners or builders. Of course, if there is any probability that the houses will have to be moved from one location to another at any time, the concrete floor is out of the picture, and the wooden floor is recommended.

c. *Dirt.*—In earlier years practically all poultry houses were furnished only with dirt floors. They went out of vogue primarily due to a feeling that they were not measuring up to the sanitary requirements of modern poultry keeping. The writer feels, however, that in many instances, especially where it is vitally necessary, from a business point of view, to lower the investment requirements of the poultry or egg farming venture, it may be quite possible to again make use of the old-fashioned dirt floor in modern poultry housing, especially for adult stock. Much will depend upon the location of the poultry house, and upon the manner in which the dirt floor is laid and managed. If the house can be located on a rise of ground, so that there is no water drainage toward the house, the possibilities of using the dirt floor are immeasurably increased. The retaining, or foundation wall, approximately eight inches wide for ordinary poultry houses, should have been securely laid and built up some eight to ten inches above the surrounding ground. The foundation wall should be sunk to a depth of approximately 16 to 18 inches below the surface, thus turning away any possible water from the area covered by the house. Then fill in the walled area with clean, damp soil, tamping it solidly and making it firm and even. It may be sprayed with a disinfectant solution from time to time. It may be necessary to remove the surface soil and replenish each spring or fall, at which times any holes dug out by the birds may be levelled and filled. The writer does not feel that the cheap, simple dirt floor is out of question even from the standpoint of acknowledging the essential character of each of the four qualities above laid down as minima for floors in poultry houses.

4. *As to Number of Stories or Levels.*—There is no essential difference between the poultry pens furnished on the second or other floors above the ground floors in poultry houses and those of the ground floor, or there needs to be no particular difference between them. In these days of close confinement of the poultry stock to buildings the possible economy of using multiple-story poultry laying and breeding houses is unquestioned, especially for relatively large operators. The New Jersey Agricultural Experiment Station, among others, has developed plans for a two-story poultry laying house. It is based essentially on the fundamentals which have been included in the usual ground floor houses.

III. **Useful Types of Poultry Buildings for the Egg Farm.**—No attempt is here made to cover this wide field of possible designs and plans of poultry buildings. Such a venture would in itself fill a large book. Rather is it the purpose now to present suggestions as to the essential buildings which the writer would recommend for the egg farm which he would set up. Naturally, the buildings here presented are those of the New Jersey Station, at which institution the writer has spent the past more than twenty-three years.

1. *Laying House.*—For the modern egg farm there must be a full complement of *laying flock housing.* The amount is to be determined by figuring on al-

lowing four square feet of floor space for each adult fowl, layer and breeder, male and female, which is to be kept in an average year's operation. The exact type or design of laying house must be selected after examination of available designs and plans.

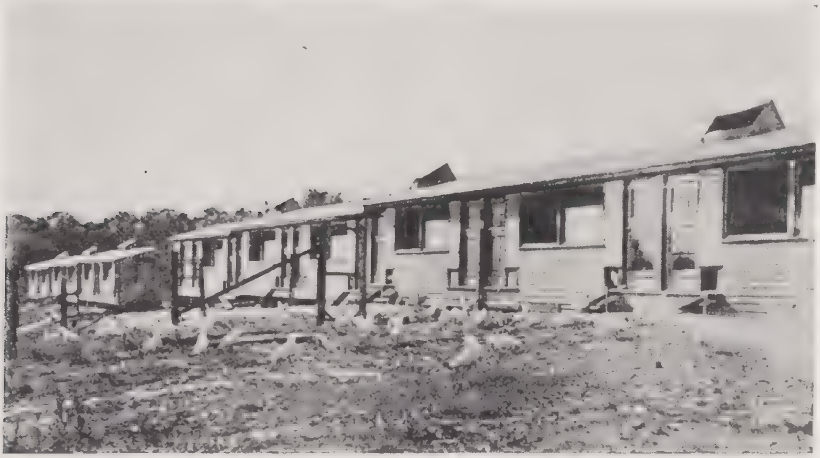


Fig. 48.—This Multiple Unit Poultry Laying House was erected on the large egg production plant operated by one of the State Institutions in New Jersey in its effort to supply fresh eggs for the people under its care.

2. *Range Shelters.*—If the young stock is to be reared on range, or in fields, range shelters are an economical and efficient means of handling the housing of growing stock. The collapsible type of range shelter which may be dissembled and stored away with a minimum of labor and cost each fall and as quickly and easily assembled the following spring is recommended. The New Jersey plan embodies this feature, and presents a workable and economical

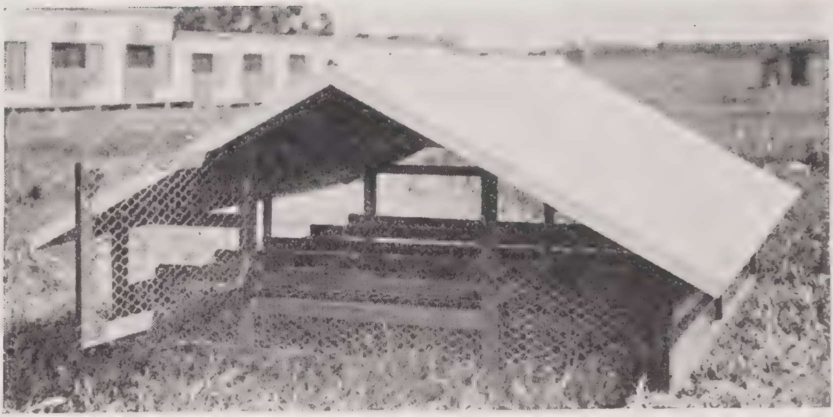


Fig. 49.—The New Jersey collapsible range shelter, built in sections, may be assembled or dissembled by one man, stored away in off seasons, and made to last for many seasons—for 60 pullets.

shelter for use on plants where poultry rearing is being conducted as a business enterprise.

3. *Colony Brooder Houses.*—There are many satisfactory types of colony brooder houses which might be constructed economically and advisedly. Again, the New Jersey 10′ x 12′ Colony House, which may be quickly converted into a 25-fowl laying flock unit, or into two single-mating breeding pens.

4. *Service Buildings.*—On every egg farm in addition to the three fundamentally essential poultry buildings—laying houses, colony houses, and range shelters—there must be certain service structures, which are usually the following:

a. Feed room. The feed room, in which feeds are stored, mixed, and measured, becomes a veritable center of activities on the modern egg farm. It should be sufficiently large to enable the poultrymen to operate efficiently and quickly, but need not be extensive, as a rule. There is no one best type of poultry feed room to be recommended, but every feed room should be centrally located and arranged so as to make the work of feeding the poultry as convenient and labor-saving as may be possible. There must be space for feed storage. There must be bin room, and a mixing floor, and in the larger plants, room for mixing machines. There must be adequate place for pails and other equipment. The whole feed room should be carefully rat-proofed, by use of wire netting, tin lining of walls, or other means, for rats and mice rob egg farmers of vast amounts of poultry feeds in the course of a year.

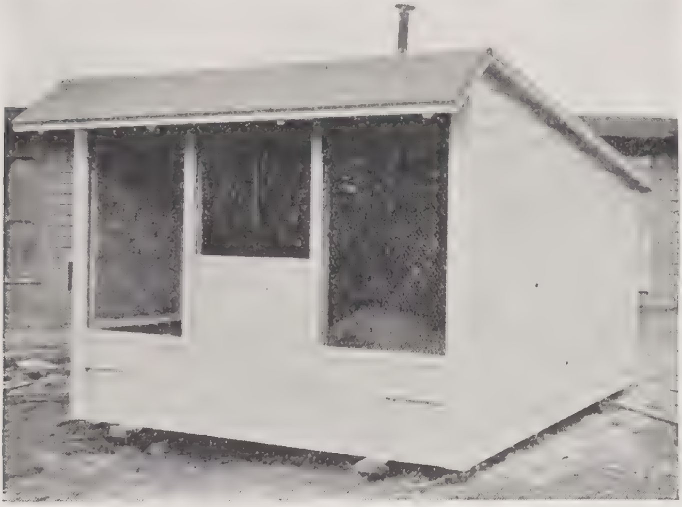


Fig. 50.—The Adjustable Colony House which may be used as a suburban flock laying house for 25 layers, a double-pen breeding house, or as a Colony Brooder House for 259 day-old chicks. (The New Jersey Style.)

b. Egg room. There must be some room, isolated from other parts of the service quarters, capable of being maintained comparatively dustless, clean, odor-free, dry, and approximately even in temperature, in which the daily egg gather may be safely stored, later to be candled, graded, and packaged. The New Jersey Station, among others, has designed an insulated egg room which may be built into some section of an existing barn or poultry house, or which may be constructed as a separate building, as the case may warrant.

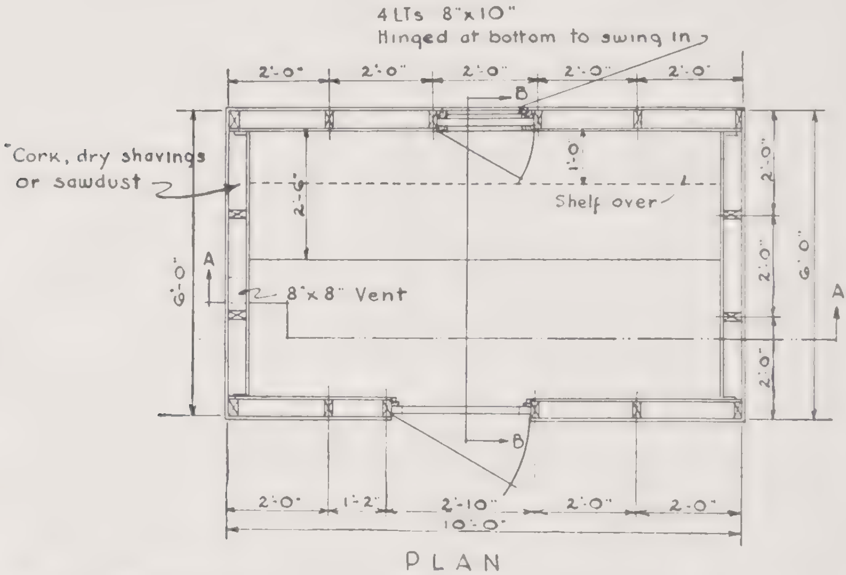


Fig. 51.—The floor plan of the New Jersey insulated egg room, which may be built as a separate unit, or as a part of some existing building.

c. Storage. Most poultry farm buildings are woefully short of just plain storage space, where litter, baled straw, bagged corncob litter, etc., poultry crates, egg cases, and many other items used on the modern egg farm may be kept. This storage should be separate from (a) the poultry houses, (b) the feed room, and (c) the egg room, and so placed as to minimize the direct contacts of the storage building with the other parts of the plant.

It is the desire of the author in this limited discussion of the poultry housing proposition to direct attention to the general principles involved and to suggest that practicing poultrymen should secure plans and specifications from their respective agricultural colleges and experiment stations, or other available sources of such detailed information. It is also his purpose to point out that much of the long-time economy of the egg farm must be determined by the degree to which the physical plant, that is the buildings, yards and ranges, helps to accomplish the primary objectives of the enterprise, namely to develop and maintain and preserve the natural, normal health and productivities of the fowls, and to induce maximum, safe growth or meat and egg yields. It is obvious that the possibilities of profits must be dependent in some part upon the amount of investment actually required for permanent buildings and equipment, and upon the length of life attaching to those buildings and equipment items. Further, it is to be pointed out that the nature and type of buildings and equipment will affect the annual expenditures demanded for coverage of depreciation and repair.

The modern egg farmer needs efficient equipment with which to handle well-bred stock, or else the attainment of quality stock will have been largely in vain. The egg farmer finds very shortly after venturing into his daily activities that his business is one which is very markedly a combination of three great forces which must all be skillfully woven together into one system of business management, if profitable egg production is to be accomplished. These three forces are:

1. Heredity is a mighty force actively at work on every egg farm, for every hen and every poultry sire is in large part capable of efficient growth and productive tendencies in measure as it has received through the medium of inheritance strength and behavior trends of certain sorts from the parent stock from whence it sprang. Because heredity is so large a force in determining results of the most practical nature on the egg farm, we have the whole program of poultry breeding presented as a major proposition. Without an inheritance of potential possibilities back of all poultry kept on the farm, no amount of fine and efficient housing will be of much avail.

2. Environment is a second potent force affecting the business possibilities of the every egg farm, and it is here, of course, that the subject matter of this present chapter comes in. Housing is the core of the environment problem, as it were. Environment must enable inherited tendencies to work themselves out in all the birds being managed on the poultry plant to optimum advantage.

3. The third great force is not always adequately appreciated in connection with poultry and egg farming, and yet it is always a force of determining character. It is the force of *human intent,* the force wielded by the person, or human element, involved, or, in other words, it is the effect which management has in the securing of economical growth or meat or egg yield. Two different persons, of dissimilar previous experience, training, education, temperament, liking for poultry keeping as a business, etc., may be given the same identical start in a poultry farm venture, same quality of fowls, and same buildings and equipment, and yet after a few seasons the two accounts might be wide apart.

The principles of poultry housing must be appreciated by all but the manner of working them out into the equipment which is to become the working tool of the business enterprise may differ as widely as the human elements vary.

IV. **The Management of Poultry in Cages.**—In recent years the trend of development in egg farming in some localities has been toward an increasing use of highly intensive schemes of management. The trend has appeared in the form of a decrease in the use of land or soil and an increase of dependence upon buildings and structures as the sole environmental factors. This trend is not universal, for there are many great sections of the country in which the continuation of the use of the usual, extensive methods of poultry and egg farming, employing yards, fields, and ranges, as well as floor management of poultry flocks in the usual types of poultry houses is the observed practice. The trend toward intensification has been pronounced in other sections of the country, however, and has been forced, in all probability, by the general economic conditions more or less prevailing in those areas. Among the contributing factors to the development of highly intensive methods of poultry culture in recent years are possibly the following:

1. The breaking up of farms into smaller units, accompanied by a general trend upward in such farm land values. The higher the land values have risen the less economical has it proved to be to attempt to use such land areas for poultry and egg production of the older style, which involves the use of considerable land acreage in order that it may be adequately worked out.

2. The desirability of producing eggs near large consuming centers, or for roadside trade, or in locations within short haulage distance of markets, for various and sundry, sound, economic reasons has forced some persons to seek methods which might make poultry and egg production possible and feasible under such restricted conditions as usually prevail in such localities. This has even been carried to the extent of exploring the possible ways and means of setting up egg farming in city lofts, barns, or buildings, vacated since occupancy for other purposes in other days.

3. The discovery that poultry can be bred and reared and managed with some degree of success

under highly intensive conditions, and without much, if any, access to the outside, or to land or soil has interested many people and challenged their attempting poultry and egg farming, whereas, under the usual farm conditions, no such intent would have been awakened in them.

4. The realization that the poultry industry was so basic in its very nature and so essential to the daily life and well-being of the average American home that it had room within its boundaries for a vast number of producers and handlers of poultry and poultry products has led to the investigation of intensive schemes of poultry and egg production which appealel to many to whom the usual methods of well-established character make no appeal whatever.

Through the operation of these and other related factors the poultry and egg industry in recent years has witnessed the discovery and development of a great variety of intensive methods of poultry and egg production. Space does not permit to mention other than a fair example of these newer ideas, namely that of the management of poultry in cages. This method, revolutionary in appearance, at least at first glance, and radically different from long-established practices in American poultry keeping, includes schemes not only for the rearing of chicks from the day-old stage on through to ready-to-lay maturity, but also methods whereby both laying and breeding stock may be managed in close confinement to cages. The writer has been the recipient of many thousands of letters from interested poultrymen and poultry women in all parts of the country during the past five years, asking unanimously for advice as to the economic stability and profit-making possibilities of these cage methods of poultry management. Because of the wide-spread interest thus manifested he has deliberately worked with the scheme in some detail and has learned at first hand some of its points, good and bad, for there is no scheme of production in any industry that does not have both its desirable and its undesirable features.

There are three parts to the intensive management of fowls in cages. Some poultry and egg producers will use one, two, or all three of them. No attempt will be made here to advocate any or all of them. Our interest at this point is to mention the management of fowls in cages as an example of one trend in modern poultry and egg farming which is very distinctive and of wide-spread interest in these days. It is illustrative of the manner through which great changes are occurring in certain of our basic industries all of the time. Sometimes they last but a day, and at other times they persist, and in still other instances they leave their marks in the form of improved methods being suggested for addition to the older persisting schemes. It is often true that while the industry as a great whole may not swing over to some new scheme it may be that the new idea will have its practical value and usefulness for some persons, and for them prove to be an economical, useful practice. The writer inclines to the belief that this may be true of the general method of intensive poultry management, including the cage management methods. There will be those for whom it works out to be extremely useful and advisable, and, at the same time, it is undoubtedly true that there will remain in the poultry industry a great army of persons for whom the older methods will continue to be the preferable ones to follow. It has always seemed to the author that one of the finest aspects of American poultry keeping has always been that feature of it which finds within it plenty of room for a great variety of forms and styles and types of enterprise.

The three basic parts of cage management of poultry seem to be:

A. The brooding of chicks in batteries, or cages, compartments up off the floor, usually arranged tier on tier, and in which space allowance has been cut to a minimum. This part of cage management has found a definite place in the brooding program of the poultry industry, sometimes as a means of handling chicks during the brooder days when some heat has been required, and sometimes as a means of rearing young stock throughout the growing or developing stages of the chicks.

Many sections of the American specialized broiler production industry have found the chick-brooding batteries an efficient means of handling the large numbers of chicks which are the basis of that branch of poultry keeping.

There is every likelihood that the use of chick batteries will continue to grow, as more and more poultry raisers find just the way in which such intensive form of chick brooding and management may fit into their peculiar situations, both as to convenience and economy. It is not to say that this highly intensive type of brooding will probably ever arise to supplant or replace the older and more extensive brooding methods. Again, the poultry industry, even the table egg production end of it alone, is sufficiently large to find and to need within

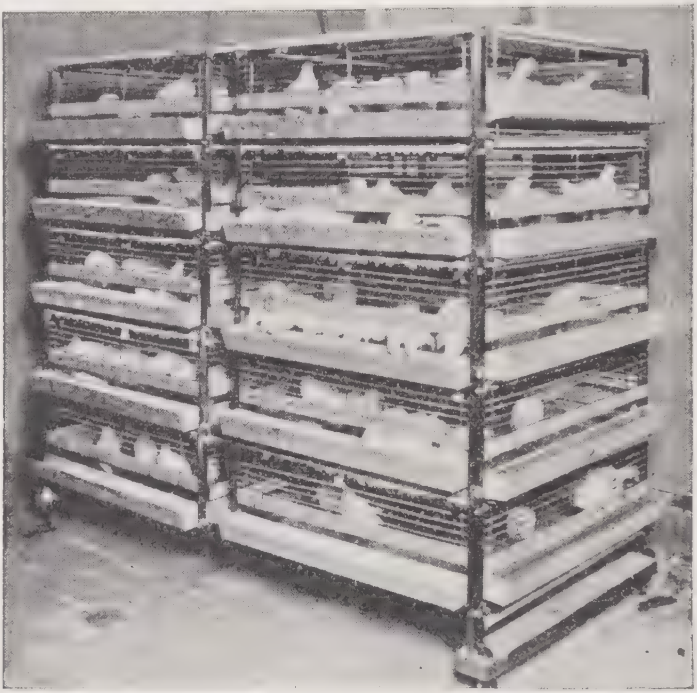


Fig. 52.—A typical battery of chicks being reared in cages, an example of the application of highly intensive management methods to the growing of young poultry stock.

it various forms of equipment and methods of handling in order that production may be set up under most efficient and economical schemes.

B. The rearing of chicks from about the twelfth week on through to ready-to-lay maturity, about the twenty-fourth week of age as a rule, is being done in cages on some plants, especially where land area is no longer available for range-rearing. It is working out with some degree of success, according to reports from those who have tried the scheme along sane and sensible lines. It is fitted into the scheme of highly intensive "egg factory" management, which employs the use of chick batteries during earliest weeks and which, when the birds are matured to laying stage of development, operates with those layers or breeders confined in individual cages. This "growing battery" is unheated, otherwise very similar to the chick battery. Best results seem to have accrued where flocks of limited size have been matured in these growing batteries, that limit being approximately a dozen individuals per unit.

C. The third type of individual cage being used by some modern poultrymen is that type which may have peculiar interest for egg farmers, people whose primary objective in handling fowls is to run them through a season under feeding and management which, at lowest possible cost, will produce the greatest possible number of good quality table eggs—laying cages, so-called. The writer has worked with several commercial types of laying cages in recent years, and submits on the basis of that experience and upon his very wide observation of many installations that the use of individual laying cages need not be any very radical departure from employment of the same fundamental principles of management which have been and are used in the established methods of floor management. The essential features of (a) ventilation, or fresh air, and removal of bad air, (b) light, (c) vitamin requirements, (d) sanitation, (e) proper food, water, and greens, (f) and protection, as well as any others which might be mentioned, with the possible one exception of exercise, are all easily, quickly, and economically furnished by the more improved scheme of individual laying cage management now in practice. It is a question somewhat open to argument as to whether or not laying and breeding hens do require anywhere near as much violent body exercise in order to remain in good health and in normal activity or productivity as has been supposed to be necessary in the past. The writer inclines to feel that the matter of exercise has been rather too heavily emphasized in some forms of poultry management.

Several interesting innovations, or striking features, in the individual laying cage management have been observed, and these are incorporated in the scheme generally, as it is now seen in the field:

1. Litterless management—no original expense of furnishing poultry house litter, no expense in handling or changing litter, and no litter as a source of the harboring or spread of disease or vermin.

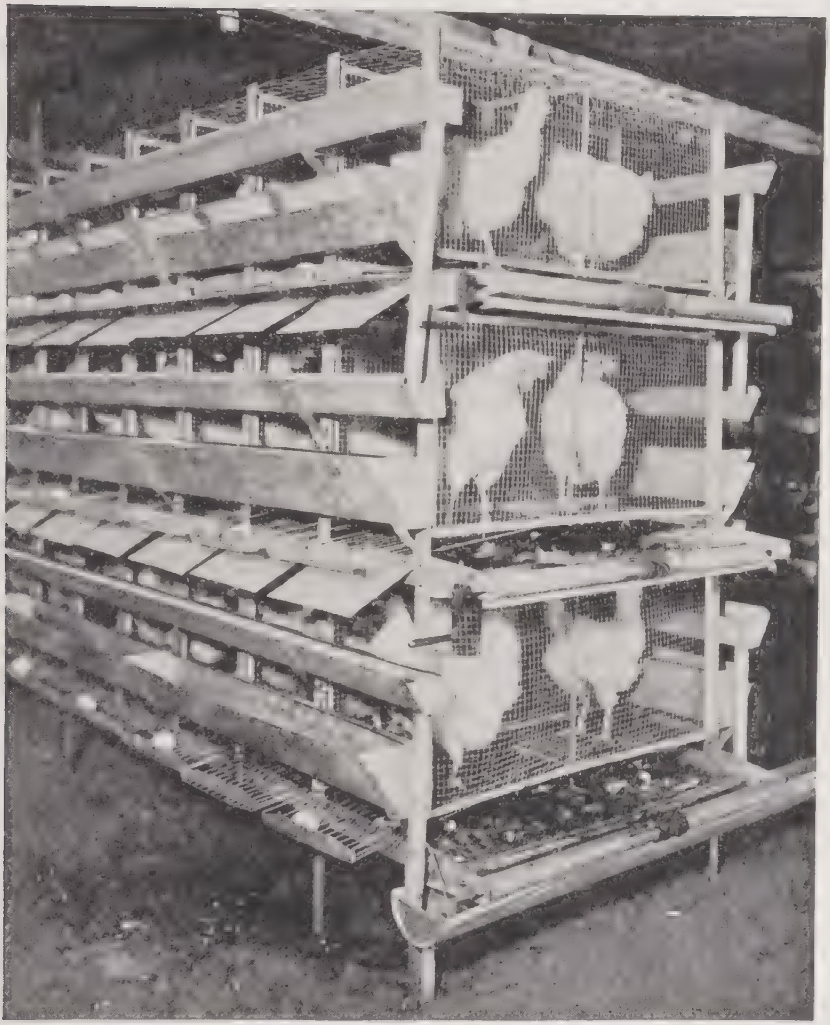


Fig. 53.—An end view of a typical individual laying cage battery in which laying fowls are confined throughout their period of usefulness as producers of table eggs.

This principle of lessening the contacts of hens with such parts of their immediate environment as may become agencies of trouble, and the litter is the chief such agency, is a valuable one to consider in any form of poultry management.

2. Possible of more complete sanitation, disinfection, and disease and vermin control. The cages are usually of metal, and wire-bottomed.

3. Lessened contacts between individuals in the flock because each individual is held within its own cage and always in the same place.

4. Unhampered access of each individual to both food and water.

5. No possibility of cannibalism, "pick-outs," etc.

6. Lessened chances of the introduction and spread of communicable diseases.

7. More fowls may be housed within a given cubic area of housing space—about three to four times as many as in the average floor management.

8. Each labor unit may care for considerably more individuals when they are in cages.

9. Automatic trapnesting, easier record keeping, and automatic culling of individuals as soon as they appear to have become uneconomical producers.

10. More uniform environmental conditions furnished.

Not all matters relating to the permanent economic value of this newer type of layer management, individual cages, have been settled as yet, either by scientific investigators or by practical egg farmers. Questions are still being raised as to the justification of the naturally rather largely increased original investment, the cost of upkeep as compared with usual methods, the cumulative effects on strains of fowls managed through several years and generations in such close confinement to extremely limited quarters, the usefulness of fowls which have spent a year in laying cages as breeding stock in subsequent seasons, and other points. Nevertheless, the scheme has been promoted upon such a wide and even national basis and has met with such degree of success to date as to make the suggested trend toward highy intensive layer management worthy of serious consideration by many egg producers.

In its connection with this discussion the important point is rather in the significance of the general trend toward intensive methods in some localities where egg farming is developing as a specialized form of poultry keeping and the trend in other places toward a return to the open fields, yards, and ranges of other years. Can one say that either is wrong? Both are taking place, and both types of management can very apparently be worked out in economical and practical terms.

V. **Poultry House Equipment Enhances Efficiency of Building.**—That is, it should! The house in itself is the general protecting environment furnished by the poultryman for his fowls, but the various items of equipment furnished for the immediate use of the birds makes or breaks the average poultry house, in so far as its being effective in inducing health and egg yields may be concerned

There are five essential groups of poultry house fixtures which are necessary in every efficient laying or breeding house:

1. *Sanitary Litter.*—It is too infrequently appreciated by poultrymen that in these days when hens are being closely confined to laying or breeding houses practically throughout the whole year those individuals must spend almost the entire part of their waking time in intimate and close contact with the litter which is used on the floor. As has been previously pointed out the litter is serving a several-fold purpose of protecting against cold, dampness, hardness of flooring materials, as well as furnishing a medium in which the fowls spend a greater part of their time. This matter of litter was fully discussed under the heading of sanitary measures in management in a previous chapter.

2. *Nests.*—The nests are naturally sought by the hens whenever they are to lay eggs. It is instinctive for hens to try to find some place of seclusion or semi-seclusion in which to produce their eggs. In the modern laying house, where numbers of egg-producers are being flocked together within a relatively small space, it is a problem of some proportions to furnish nesting equipment for the hens. There must be enough nests to accommodate all layers, minimize breakage of eggs by overcrowding in nests, and to induce greater egg yields. A good laying house should provide at least one nest to each five fowls. The nests, usually placed either under the droppingsboards, or along the side walls,

should preferably be somewhat protected or hidden, this usually resulting in a minimum of breakage or egg-eating. The nests should be sufficiently large to provide comfort and lessen the chances of cracking or breaking of eggs. A nest approximately 12″ wide x 15″ deep and 14″ high suffices for the average-size fowls. Nests are usually arranged in tiers, for economy of use of space.

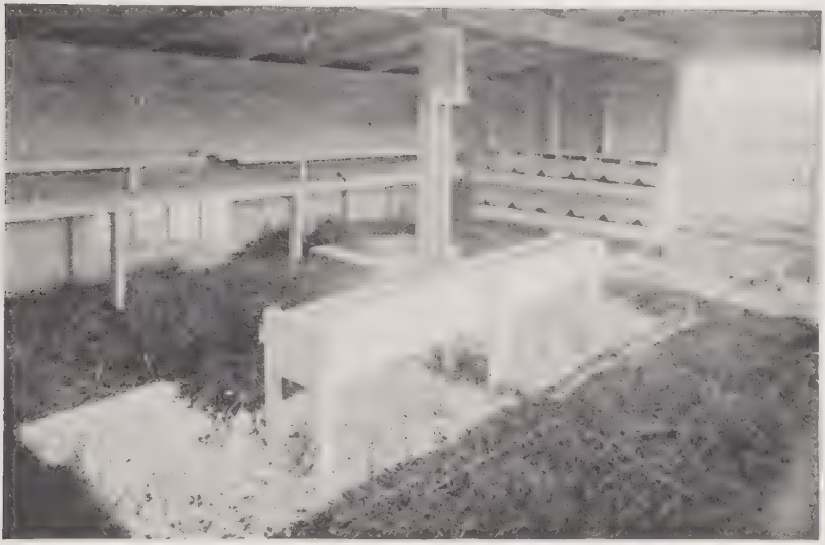


Fig. 54.—The interior of a modern poultry laying house which has been made ready for occupancy by new pullet layer flocks. Note the locations of the various items of equipment.

Nests should be kept scrupulously clean at all times, both as a disease-and-vermin-fighting measure, and to help insure the gathering of clean eggs, and to cut down on stains. Nests must be kept well bedded with clean, dry litter material. Coarse pine shavings are an admirable nest litter. Corn cob litter, and other clean, dry, non-dusty litters may also be used. If straws or hay are used, they should be cut, as long wisps often become entangled, catch on the hens' feet and sometimes lead to destruction of the nest and loss of good eggs. An ordinary egg case filler, consisting of an excelsior pad, may be used satisfactorily as a nest litter. It must protect the

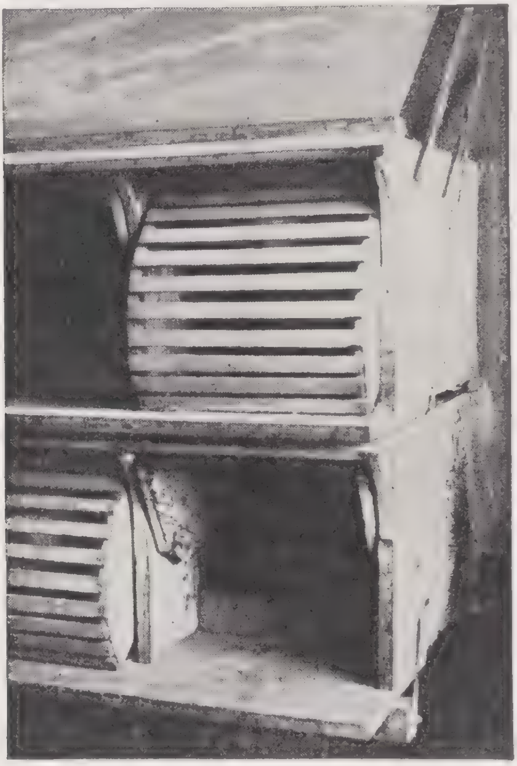


Fig. 55.—The cylindrical type of trapnest employed at the Hunterdon County egg laying contest, Flemington, N. J., has many points of interest, especially as to comfort and sanitation.

eggs against the hard floor of the nest and prevent them from rolling around in the nest as the hen moves about in it.

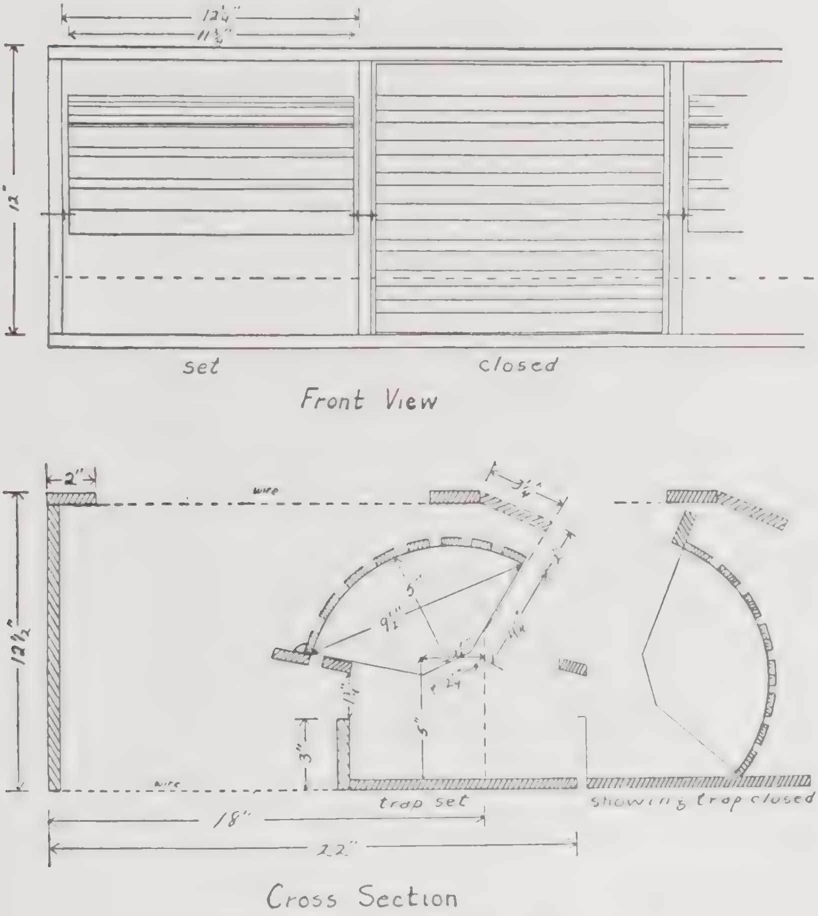


Diagram of trapnest shown in Fig. 55.

3. *Food and Water Utensils.*—All food and water containing utensils, hoppers, troughs, or dishes, or whatever type may be used, should be elevated off

the floor of the poultry house pens, leaving the floor space free and, more important, protecting the food and water supply from litter being scratched into them. There must be ample food hopper space; for example, allow at least a six-foot long V-shaped dry mash trough, or any usual type mash hopper, to every 50 layers. One water fountain for every 50 hens should also be provided. The fowls must be allowed to eat and drink at will, and as much undisturbed by other birds as may be possible to bring about. That lesson has been well taught through individual cage management. No special type of food hopper will be found best. Any hopper, however, should invite use by the fowls, through being simple in construction, open, and accessible. It should protect the food from contamination, and should keep the fowls from getting into the hoppers, thereby bringing their feet into direct contact with the food they are eating. The hoppers should be so built as to reduce waste to a minimum. Similarly, the water fountains, or watering systems, should be clean and sanitary, and yet made usable by the birds at all times. In sections where winter temperatures drop to low levels below the point of freezing, it may be necessary to supply some sort of warming device to prevent freezing of water and to induce normal water consumption during cold weather.

4. *Manure.*—The problem of handling the poultry droppings voided by the fowls while on the perches at night has been solved variously, but usually through the use of

a. Droppingsboards, built as a level, flat, smooth platform, located about four to six inches beneath the perches. These devices may be cleaned off periodically, and should be cleaned at least twice per week, and preferably daily, in order to maintain a higher degree of sanitation within the poultry house. Gypsum, or land plaster, or other drying agency of similar sort which will enhance rather than lower the fertilizer value of the poultry manure, may be spread in thin layer over the cleaned droppingsboards after each cleaning. It aids in the handling and storing of the poultry manure.

b. Manure pits, built beneath the perches, and so arranged as to hold the accumulated droppings over a considerable period of time. Only in rare instances does the writer feel that the manure pit should be employed in the modern poultry laying house.

5. *Perches, or Roosts.*—The fowls spend approximately one-half of their time on the perches, at night, or in darkened hours when they are not active on the floor. The perch space should be ample to allow each fowl comfort while at roost, which is secured by allowing approximately six to eight, preferably the latter, of linear space in perch room. 2″ x 2″ material, rounded as to upper edges, makes a cheap and satisfactory perch material. Metal perches are sanitary and satisfactory, although usually costing somewhat more than wood. Perches should be examined frequently to make sure that no red mites are being harbored in the crack and crevices in and

about the perches. If found, paint the perches and surrounding parts of building with some good red-mite destroyer, or strong disinfectant solution.

Conclusion, as to Housing of Poultry.

Housing directly effects both rate and amount of egg yield. It is a factor of paramount importance on the modern egg farm. It need not be complicated nor exceedingly expensive. It should be kept simple in design, and economical in original cost and low in repair and upkeep. The usual poultry houses must be kept painted and in good repair, in order to be durable and long-lived. Good housing does not make good layers out of inherently poor birds. Breeding must be kept ahead of housing and management, but housing and management must keep abreast of breeding development. Good fowls may have been bred only to be ruined by poor housing and management. Seek sound, economical plans and designs for poultry buildings advised for the given locality, and proceed to adjust them to the individual needs of the plant.

The author acted as secretary of a nation-wide committee on poultry housing, appointed by the Rutgers University Farm Building Institute, in 1944. A report on "Poultry House Requirements" has been issued, dated May, 1947, as N. J. Bulletin 732. It presents exhaustive findings as to "the functional requirements for modern poultry structures.

VII

A PRACTICAL FEEDING PROGRAM FOR THE ADULT POULTRY FLOCKS ON THE MODERN EGG FARM

VOLUMES could be written upon the subject of the feeding of adult poultry flocks. There are almost infinite ways and means of quite properly feeding fowls for economical egg yields. In this book there is room only for a presentation of the practical principles which must be the basis of any satisfactory poultry feeding program, and for illustration of the working out of those principles through the outlining of a workable scheme of adult poultry feeding which the writer has found to be productive of economical results.

I. **Chief Characteristics of a Good Poultry Feeding Program.**—It is assumed that the readers of this book are primarily interested in poultry feeding from an ultra-practical point of view, that is from the standpoint of what to feed, when to feed it, and why results might reasonably be expected. There are certain features which any and every poultry feeding program must possess:

1. *It must adequately serve the purposes for which the feeding is done.*—No feeding program, no ration, is satisfactory unless it accomplishes what is

needed to be done. On the egg farm, or wherever flocks of fowls are being kept for egg production, in small or large numbers, it matters not, the primary purposes of any feeding program must be

a. To furnish the fowls with the food nutrients which are required for the normal and natural maintenance of the bodies of the birds in healthful condition,

b. To supply those added nutrients which will stimulate increased activities of those body organs, parts, and processes which result in increased rate and amount of egg production.

2. *It must contain the essential food nutrients.*—In a broad and practical sense food nutrients consist of those elements contained in ordinary food stuffs which are required by the body in order to function. In poultry culture one might conceive of the food nutrients as being those parts or elements of ordinary food stuffs or combination of food materials which are needed in order that fowls may be continued in normal health and productive activity, and even stimulated in either. The food nutrients are those phases of common food stuffs which must be taken into consideration in the compounding or mixing of poultry rations in an effort to insure that those rations may be made to serve the basic purposes mentioned just above. In this broad sense, therefore, the essential food nutrients which must be furnished efficiently by any good poultry feeding program will be found to include the following:

a. *Water.*—Water is an important constituent of both hen and egg, and in order that normal poultry bodies and normal eggs may be grown it is obvious that a corresponding proportion of water must be made a part of the poultry rations. Further, water is an indispensable factor in the normal functioning of all the body processes of the fowls. Deprived of water in sufficient amount, hens cannot continue to function normally. Ill health, or even mortality, and abnormal production behavior result. Water softens food materials and renders them more quickly and efficiently usable by the hens. It aids in the processes of digestion and absorption of foods. It materially affects the rate and amount of food actually used by fowls. It makes possible the normal activity of the blood stream as a carrying agency for the assimilated food materials, and their transfer from part to part within the fowls' bodies. Water aids in the direct control of body temperature, and it acts as a lubricant of the joints and muscles of fowls. So many and varied and indispensable are the uses of and needs for water in the diet of the domestic fowl that it is impossible to over-estimate the place which it holds in the feeding program.

The average Leghorn fowl, for example, is comprised of approximately 55.8% of water; the new-laid egg contains approximately 65.9% of water.

Water is one of the inorganic nutrients required in the poultry feeding program. It is the cheapest and easiest to procure and furnish, under average conditions. Nevertheless, it is the one phase of the feeding program which is too frequently slighted or indifferently handled.

The water required by poultry must be furnished by both of the following two ways:

1. Clean, pure, fresh drinking water, furnished as a beverage, and kept before the fowls at all times. Never allow the source of drinking water to become (a) exhausted, (b) dirty or polluted with filth,

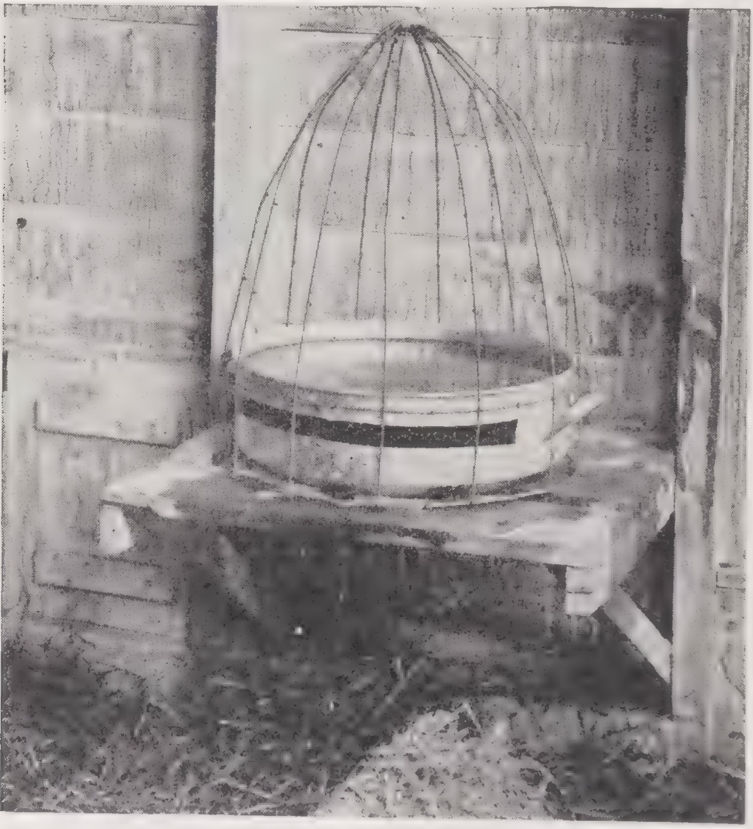


Fig. 56.—A simple wire frame device for protecting the water pan from filth and pollution. The water pan is on a platform.

manure, etc., (c) or slimy or unsafe, due to too long standing. Especially if hens are being brought down from the perches through the use of artificial lights in otherwise dark hours, is it necessary to have a water supply ready for those fowls. Drinking water is needed and required by fowls for consumption in connection with grain and mash eating. The wetting of the dry ingredients which usually constitute poultry rations, as the birds eat, makes for quicker digestion and more economical effects of the ration as a whole.

2. Water as a part of some phase of the ration, such as in green, succulent food stuffs, as sprouted oats, green alfalfa, mangel beets, or cabbages. The use of wet mashes as a supplement to dry mash methods of poultry feeding illustrates another means of increasing the water intake of hens. The use of liquid milks in poultry feeding in recent years has added still another means of insuring further water intake.

b. *Minerals.*—The other inorganic nutrient which is essential to be included within satisfactory poultry rations is the mineral content of the food stuffs used. Sometimes the poultry feeder refers to the mineral elements of the rations he uses by the term ash content. At any rate, what is included within this group of nutrients is a rather large number of mineral compounds which are a part of the bones, tissues, egg shells, and eggs. Minerals are essential to the normal formation of and to the maintenance of the skeletal framework, that is the bones.

of the fowls. They are required for the building up of and the repair of muscles and all other body tissues. They are an integral part of all parts of the egg. It is obvious that the processes of growth, or body development, and the processes of body repair, that is maintenance, as well as the process of excessive egg formation, will all require relatively large quantities of the various minerals usually found in food stuffs. Calcium is probably the most important mineral element required in the poultry ration, especially for adult stock, layers, egg-producers. It forms, as a carbonate, nearly the entire egg shell, and, in combination with phosphorus and magnesium, an important part of the bones of fowls. Other minerals, required for the making of feathers, muscles, body parts, or for egg formation, or for proper body functioning and the various processes, are potassium, silicon, sulfur, sodium, iodine, and iron. There may be others.

To fail to include these essential mineral elements within a feeding program would be deliberately to withhold indispensable ingredients to normal poultry health and activity. It is fortunate that the usual rations concocted for poultry feeding purposes do, without much special provision, contain more than an abundance of these required minerals. The rations hereinafter mentioned have been built with due regard for the mineral needs of laying and breeding fowls.

c. *Proteins.*—Proteins are nitrogen-bearing compounds of carbon, hydrogen, oxygen, and sometimes sulfur, phosphorous, and iron, and constitute a group of organic materials, or nutrients, which are essential to normal poultry life processes. Proteins vary widely in chemical composition. In nature proteins are greatly varied. The ordinary food stuffs contain probable hundreds of different kinds of protein substances. In all of these, however, the amino acids to which the proteins may be broken down by chemical processes, are fairly limited, being about 20 in number. Certain of these amino acids are more essential than others. It becomes somewhat a matter, then, of furnishing in poultry rations those forms of proteins which do furnish, in turn, the essential amino acids. Unless the proteins contained in the food stuffs used do furnish the essential amino acids they may be said to be "incomplete" proteins, in so far as poultry feeding is concerned, since they will not serve the purposes of the fowls completely. This is primarily why it is necessary in a modern poultry feeding program to furnish proteins from various sources in an effort to insure "completeness" as to amino acids furnished.

In so far as practical poultry feeding is concerned protein nutrients are of one or other of two sources:

1. Proteins from some animal source. These protein feeding stuffs include animal meals, meat scraps, fish meals, and milk feeds of various sorts, as well as lesser used food stuffs, such as crab meals, etc. These proteins, as the name implies, have been derived from animal sources. They have been parts of animal body tissues, or have been produced, as in

milk, by animal body processes. The proteins from animal sources vary widely in their nature and amino acid contents. The various meat scraps, meat meals, milk feeds, and other animal protein concentrates, as they are usually referred to in the trade, are not necessarily always uniform either as to percentage of protein content or as to types of proteins to be found in them. When one stops to consider the sources of most of the animal protein concentrates used in poultry feeding he realizes that such wide variation is most apt to occur. Experimentation and experience have both proved conclusively that some protein concentrates of animal source are essential to a complete protein ration for economical poultry feeding. The mineral content of most of the protein concentrates of animal origin is high and constitutes an automatic source of required minerals, with the exception that calcium usually must be furnished by special provision.

2. Proteins from some vegetable or plant source. Considerable interest has been attached to the possibility of using certain available protein concentrates of plant origin at least in partial fulfillment of the protein requirements of poultry rations. Price differentials, as well as promotion of the raising of certain protein-high crops, such as alfalfa, soy beans, clovers, etc., have helped in stimulating interest of poultry feeders in protein concentrates of plant or vegetable origin. Further, the appreciation of the need for a wide variety of kinds of proteins in modern poultry rations has directed investigations to-

ward the protein bearers of plant as well as animal origin.

The proteins contained in poultry rations primarily bring about increased egg yield. Of course, maintenance requirements are met first, but the amounts of proteins required for maintenance of layers and breeders is not high, and the greater percentage of protein nutrients contained in adult poultry rations are used in the stimulation of those body processes which result in increased egg formation and production. The mash portion of the average poultry ration is the part of the feeding program which is especially high in protein, averaging something like 16% to 20% in ordinary egg mashes, perhaps. Growing mashes, like laying mashes, are usually high in protein-bearing concentrates.

Fig. 57.—The plate of complete-ration pellets represents the balanced ration needed by layers, while the eggs represent the end products of the Table Egg Production Industry.

Therefore, the practical feeder, appreciating that considerable amounts of protein nutrients are required by his fowls, and that a variety of proteins and therefore of amino acids are needed must plan his rations and feeding program so as to accomplish these things and it is not particularly essential that he worry about the names of those protein forms, or of the amino acids. He should seek a variety of proteins and attempt to secure them economically.

d. *Carbohydrates.*—The term carbohydrates includes a wide group of carbon, hydrogen, and oxygen compounds, such as starches and sugars, which are employed largely in poultry feeding for the heat or energy or fat which results from their use. They are not to any extent body or egg builders. They are the chief constituents of the maintenance part of the rations. Heat and energy are constantly required by the poultry body, and must constantly be supplied. To have a sufficient content of carbohydrates in poultry rations is as essential as to have plenty of proteins or minerals. It is relatively easy to secure an abundance of these nutrients. Too high contents of carbohydrate food nutrients in laying rations must be avoided, since they will tend to create the formation of excessive body fat and work against increased egg formation. The ordinary grain food stuffs used in poultry rations are rich in starches and sugars and furnish the principal sources of carbohydrates in such rations.

e. *Fats.*—From a chemical point of view, fats furnish the same sort of nutrients as do carbohydrates.

namely heat and energy and fat, but they are so composed as to do this at about two and one-quarter faster rate. Therefore, to reduce fats contained in poultry food stuffs to the equivalent basis of starches and sugars, that is carbohydrates, one must multiply the fat content by 2.25. Most ordinary food stuffs do contain some digestible fats or oils and it is rarely necessary to add any special ingredients to poultry rations to furnish essential fats.

f. *Vitamins.*—It may be erroneous to classify vitamins as food nutrients, but in this place it is done with the thought that, broadly speaking, food nutrients include all the factors supplied in food stuffs which are effective in furnishing the needed nourishment of fowls. In this sense, then, vitamins may be considered in this connection, for they are elements without which proper nutrition cannot take place. A survey of research reports in the field of vitamin study reveals that apparently the practical poultry feeder must furnish to his adult poultry stock a certain complement of vitamins in order that they may be maintained in health and held to desirable functions. The poultryman must have the following vitamins carried by some of the ingredients used in his rations:

1. Vitamin A, long recognized as essential to the normal growth and development of chicks, sometimes called the "growing vitamin," is also apparently needed by adult fowls, although in smaller proportions probably. Its absence in the rations of adult fowls causes "nutritional disease," or a form of

swollen eye, xerophthalmic in nature, and nodular formations in the œsophagus lining. It must be supplied in essential amounts in order that adult fowls may continue in normal health. It is found in considerable abundance in yellow corn, green foods, milk, egg yolks, and cod-liver oil, all ingredients (with possible exception of egg yolks) quite generally used in the making of modern egg production mashes, or rations. It is not difficult to insure that any mixture is amply furnished with Vitamin A, and the rations suggested in these pages, other things being equal, will be found sufficient in this regard.

2. Vitamin B, the anti-neuritic vitamin, is essential to a control of the nervous system, apparently, for its absence hampers growth, creates polyneuritis, prevents normal development of the internal organs of secretion, and usually results in a depressed appetite. Scientists are tending to divide this vitamin into two or more distinct parts. The vital point for the poultry feeder, however, is to recognize the necessity of including some Vitamin B-bearing food stuff in the ration in amount to insure a sufficiency in this regard. The seeds of grains, especially the germs, are rich in Vitamin B. Yeast furnishes it. The ordinary feed mixture used for layers and breeders probably is high enough in this vitamin without special ingredients being added. If such are needed, the use of animal feeding yeast is advocated.

3. Vitamin C, the anti-scorbutic or anti-scurvy vitamin, has not yet been demonstrated to be essen-

tial to poultry feeding. Tomato feed, a by-product of tomato juice manufacture, is offered in some places because of its Vitamin C content. It is not needed for this purpose, but that feed, at a reasonable price, may have other values in the poultry ration.

4. Vitamin D, the anti-rickets factor, is one of the most essential for both young and adult poultry stock feeding. Its absence causes rickets and abnor-

Fig. 58.—In an industry which now manages laying flocks largely under a system of close confinement to the houses during the first laying year the furnishing of cod-liver oil, green food, and other supplements to the rations is an attempt to make up for lack of sun-light and other factors formerly secured in the out of doors environment.

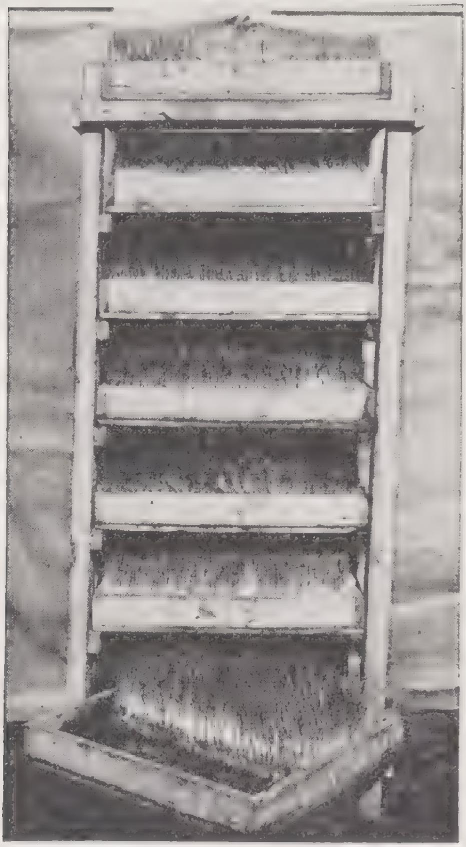


Fig. 59.—The use of sprouted grains in poultry feeding as a means of furnishing vitamin as well as for other beneficial effects of such succulent food stuffs is not infrequent or unusual.

mal bone formation and general failure to normally assimilate and use minerals. Thus egg producing birds are hampered from normal functioning by a lack of this vitamin. The exposure of hens to the anti-rachitic effects of the direct sunlight, through its ultra-violet rays presumably, is one way of securing this needed factor, but, under modern methods of housing and management the securing of essential amounts of this Vitamin D factor by means of direct sunshine has been found to be spotty and unreliable. A more even, uniform supply is needed by hard-worked hens. Cod-liver oils, or sardine oils, have come upon the market in vast quantities to meet this requirement. Green foods, milk, and other concentrates used extensively in ration making also contribute toward a Vitamin D supply.

5. Vitamin E, a vitamin which is supposed to affect fertility in animals, has been listed by many as being an essential for poultry, especially breeding fowls. It may be, and in order to be on the safe side, it should be considered in the forming of the ration. Green food, however, seems to satisfy the requirements of hens in this regard, so far as is known at present.

6. Vitamin G, the anti-pellagra, and other very recently discovered vitamins may also play some part in controlling the processes of poultry nutrition. It is probable that the rations as they are now constructed, however, will automatically fulfill the needs for all these miscellaneous vitamin factors. It is not felt that poultrymen need to worry much about them at present.

3. *The nutrients must be properly balanced.*—This means that there must be some rather definite relationship between the amounts of the respective nutrients furnished in a given ration, if that ration

is to accomplish its purpose efficiently and economically. Lack of this balance usually means waste, and failure of securing the end in view, the objective of the feeding operation, which in the case of the egg farmer, is egg yield. Generally, in order to get the matter of balance of nutrients down to a practical and measurable basis, it becomes a matter of

a. Determining the "nutritive ratio" of the proposed ration or mixture, or even of a specific food stuff. This is an arbitrary measurement which has been suggested through which one might state the relative contents of protein and carbohydrate (fats included) nutrients in the given food stuffs or mixtures of feeds. It is simply an expression of the number of pounds of carbohydrates to every pound of protein to be found. This is, of course, in terms of digestible carbohydrates, proteins, and fats, for fowls are benefited only by those nutrients which are assimilated by their bodies and therefore used by them. Determine the total number of pounds of digestible fats in the given amount of the given food stuff or mixture of feeds, multiply this amount by 2.25 in order to reduce the available fat nutrients to terms of starches and sugars, add the number of pounds of digestible carbohydrates, and then divide that total by the number of pounds of digestible proteins in the same given amount of the given food or mixture. Thus, is expressed a ratio which shows the relative content of proteins and carbohydrates and fats, the latter two taken together.

It is usually agreed that the average laying ration should run a nutritive ratio of approximately 1 : 3.5, made up of a grain mixture which will average approximately 1 : 5.5, and a mash which may run as narrow as 1 : 2.5. The smaller the amount of carbohydrates contained per pound of available, digestible proteins, the narrower the ration is said to be, and, conversely, the larger the proportion of starches, sugars, and fats contained per pound of proteins the wider is that ration said to be.

In order to figure nutritive ratios it is necessary, obviously, to have recourse to some standard text in which chemical composition and digestibility figures are given, such the universally used "Feeds and Feeding" by Henry and Morrison.

The writer has long felt that another phase of ration making in this regard of nutrient balance might be a certain complementary effect which might be secured when certain mixtures of nutrients or food stuffs were used and which might not result from certain other mixtures in which similar proportions and the same types of nutrients had been used. The poultry feeder must determine, largely through trial and experimentation, the foods and mixtures of foods which seem to render the results that are most satisfactory from a practical and economical point of view.

b. In commercial poultry ration-making the following common grains, grain by-products, or milled products are frequently used. It is useful to know at least in a general way what the nature of these food stuffs may be, and an approximation of their digestible nutrient contents, in order that some idea of the effects of their respective uses may have upon the nutritive ratio of the mixtures made.

1. *Yellow Corn,* the ordinary American field maize, is one of the most commonly used ingredients of modern poultry rations, both for young stock and adults. It must be looked upon primarily as a rich source of carbohydrates (mostly starch), fats, and therefore, as a food stuff which will function primarily in energy, heat, and body fat formation. The protein in corn is very incomplete as to essential amino acids, and is not to be counted upon as contributing significantly to the protein requirements of any poultry ration. Because corn is essentially a fat and energy producer it must always be used with care. Too many laying flocks are over-fed on corn and become excessively fat, and consequently less capable of heavy functioning in egg production. Yellow corn is rich in Vitamin A. The corn germ is rich in Vitamin B. The whole corn kernel, preferably, should always be used in the concocting of poultry rations, whether desired for use in whole, cracked, or ground form. The usually accepted content of digestible nutrients in average yellow dent corn is 5.45% protein, 65.58% carbohydrates, and 4.59% of fats. American poultrymen have been rather extensive users of maize in the manufacture of their rations, as compared with English poultrymen. The use of fairly large amounts of yellow corn in laying and breeding rations is to be recommended, and will practically always tend to lower

the per-pound costs of the finished rations. Note the important part which yellow corn is made to play in the specific rations in following paragraphs, as well as the significance which was attached to corn in the chick rations given in a preceding chapter.

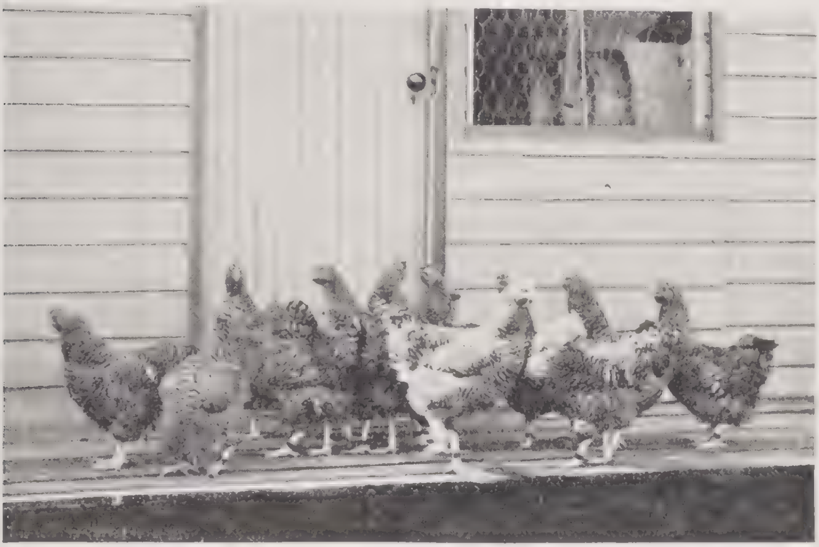


Fig. 60.—The Barred Plymouth Rock has proved to be one of the most popular egg producing and general purpose fowls in the country, especially for use on general farms.

2. *Wheat,* another grain crop abundantly raised in America and almost always available to poultry feeders at reasonable prices, is a remarkably fine grain for poultry ration making. Its proteins are far more complete than are the proteins of maize. The use of wheat, either whole, cracked, or as ground whole wheat, in various types of poultry rations is widespread in this country. The wheat by-products,

available from flour mills and breakfast food factories, have added whole series of useful poultry food stuffs to the existing lists. The average feeding wheat is generally calculated to carry 9.78% of protein, 63.58% of carbohydrates, and only 0.84% of fats. Many egg farmers will grow wheat on their own acres and feed it generously to their poultry flocks.

3. *Wheat Bran* is the first by-product of the milling of wheat in flour making. It comprises largely the outer layers of the wheat kernel, and a large amount of the important aleurone layer. Wheat bran usually contains from 5 to 7% of phytin, a phosphorous-bearing compound, which is mildly laxative. The employment of wheat bran in the poultry ration is thought to have a beneficial physiological effect upon the fowls. The fiber of wheat bran is soft, not harsh and cutting. Wheat bran gives bulk to the mixture and tends to prevent the ration as a whole from becoming too heavy and closely packed. Fowls like it and the rations to which it has been liberally added. It is fairly rich in Vitamin B, but is low in minerals, especially lime. The usually used composition figures for wheat bran are 10.29% protein, 32.86% carbohydrates, and 2.45% fats.

4. *Wheat Middlings* consist of the finer particles of wheat bran and the coarser bits of flour, with some germs. It is, of course, the next step in flour manufacture. There are several grades of wheat middlings on the market for livestock and poultry

feeding. Poultrymen usually may use "flour middlings," which grade contains relatively more flour and finer bran particles, with good results. The digestible nutrients content of flour middlings varies widely, as would be expected, but, for purposes of ration computing, the composition of 13.4% protein, 46.2% of carbohydrates, and 4.3% of fats is useful and sufficiently accurate.

5. *Oats,* another cereal grain crop of great economic significance in this country, is extremely valuable to poultry feeders. There is probably no one other cereal grain which may be used in a greater variety of ways than the oat. This is true, in spite of the high indigestible fiber content, nearly 30% of the oat kernel. The kernel itself, however, is a wonderfully well balanced food. Its proteins are complete in their range of amino acids. The usual composition of oats used in ration-figuring is 8.66% protein, 36.24% carbohydrates, and 3.7% of fats. Oats, that is the whole kernels with hulls attached, are widely used as ingredients of poultry scratch grain mixtures. Whenever possible poultrymen should use only good heavy oats, weighing around 38 to 40 pounds to the bushel, for such grain feeding purposes, or for grinding. The English oats, so widely used by English poultrymen, are always extremely heavy oats, probably one important compensation for the usual English climate of much moisture and cool temperatures in summer months. Besides being used as a grain oats are used otherwise by poultrymen as follows:

a. Oat straw, either the threshed or the unthreshed, is a preferred straw for poultry house litter, being bright, clean, and not too stiff and hard, and free from the objectionable beards of barley and wheat straws.

b. The young, green oat crop, as a cover crop, for green manuring, or as a soilage crop, to be cut, chopped, and used as a source of green, succulent supplement to the poultry ration, finds wide favor among egg farmers.

c. Similarly the use of oats for sprouting purposes is widespread. (See Figure 59.)

d. Clipped oats are used in preference to whole oats, since in the process of clipping a considerable percentage of the indigestible, harsh, cutting oat hull fiber is removed.

e. Pinhead, or steel-cut oats, are hulled oats, cut once or twice, but not rolled flat. This product is, in the opinion of the writer, one of the most perfect foodstuffs ever offered to poultrymen, especially for use in chick rations. Its composition approximates 11.4% protein, 57.7% carbohydrates, and 7.5% of digestible fats. Unfortunately, the market price of this oat product is sometimes so high as to make its use prohibitive to poultrymen.

f. Rolled oats are similar to pinhead oats, except that they have been run through rollers and flattened. Rolled oats are used rather extensively in chick rations, and in some rations for adult fowls. In composition they should not differ materially from steel-cut oats.

g. Ordinary ground oats are, as the name implies, the whole oat kernels ground, inclusive of the hulls. If the grade of oat is heavy, that is 40 pounds to the bushel or more, ground oats make a most desirable ingredient for poultry rations. If, however, heavy oats are not to be had for rations to be fed layers and breeders, it is advisable to use steel-cut oats in the mashes in place of ground oats.

6. Alfalfa leaf meal, or alfalfa meal, known variously on the market, is considered to be an important vitamin bearer and a foodstuff quite rich in valuable proteins and minerals. Its use in the poultry diet insures richness of yellow pigmentation in skin and shanks of fowls, and also darker color in the egg yolks. Its use in the rations for breeding fowls is of particular significance. The average grade of alfalfa meal used for poultry feeding runs approximately 14.3% protein, 35.8% carbohydrates, and 2.0% fats, while the higher grade alfalfa leaf meals (containing more of the leaves of the alfalfa plants than stems) run nearer 22.5% in protein content, 41.2% in carbohydrates, and 3.4% in fats. It is important to note that the better leaf meals may run as high as 13.6% in minerals, while the ordinary alfalfa meal will contain about 9.0% of minerals. The factor of price, and sometimes that of availability, often limit the use of alfalfa meals in poultry rations.

The alfalfa crop, as a green crop for inclusion in extensive poultry range rotation schemes, has already been emphasized. It is often found most desirable as a soilage crop, for cut greens hauled in to confined chicks and adult flocks. Its usefulness is enhanced by the fact that the nature of its growth makes it available in succulent form throughout the spring, summer, and fall seasons. It is a rare soil-improving crop and may be fitted into the farm management which is looking toward soil improvement and conservation. The poultry and egg farmer must do his share in this national enterprise, for he will desire to reap a share in the benefits of that movement in later years.

7. *Meat scrap* is a commercially available by-product of the great slaughter houses and meat-packing industries. It is a protein concentrate of animal origins. Because of the great variety of possibilities which may enter into the manufacture of meat scrap it is general experience that meat scraps available to poultry feeders are not particularly uniform in protein content or even in the types of proteins contained. On the average, however, commercial meat scrap contains approximately 39.60% of digestible protein, and 10.30% of fats, being totally deficient in the carbohydrates. Great care should be exercised in the selection of the grade and make of meat scrap to be used in poultry feeding, and it is usually advisable to adhere to the use of the same one, once a satisfactory scrap has been located.

8. *Fish scrap* is fed for similar reasons as is meat scrap, that is for protein of animal sources. It again varies rather widely, depending upon which fish

are used in its manufacture and the processes employed. Ordinarily it may be figured as having about 47.11% of digestible proteins, and 1.96% of fats. The writer has always preferred to use both meat scraps and fish scraps toward furnishing the required proteins of animal source, feeling that the greater variety of proteins thus furnished was of considerable value.

9. *Milk Products.*—One of the epoch-making discoveries of the early part of the present century in the poultry field was that of the practicality and usefulness of milk feeding in the nutrition of poultry of all ages and for all purposes. There are several forms in which milk is being used for poultry:

a. Liquid milk. This may be in the form of (a) whole milk, sweet or soured, (b) buttermilk, the by-product of butter-making, (c) soured skim milk, natural or cultured, (d) or whey, by-product of cheese making. On many a farm there is some skim milk available for which there is little market demand. It may often be fed advantageously to the laying and breeding flocks, as a beverage. It is preferable to always feed it in soured condition, any time after it has formed a thick clabber. Place a small amount of sour skim milk in each new lot of sweet skim milk, and set it in a warm place for a few hours during which time the process of souring will have taken place. Give fowls all they want. It will greatly stimulate their appetites, and furnish in itself, quickly digested and highly nutritious food nutrients, particularly proteins and milk sugars.

b. Semi-liquid, or condensed milk products are widely used, either diluted about six times with warm water, or fed as they come from the dealers as a paste.

c. Milk powders include (a) dried skim milk, (b) dried buttermilk, and (c) dried whey (high in milk sugars, sweetish in taste, and usually considered a factor in adding to the appetizing character of rations). While these milk powders are unusually valuable poultry food stuffs, in so far as quickly digested and rapidly assimilated nutrients are concerned, and their uses are of unquestioned benefit to most rations, market prices are often high and should be watched carefully. Dried skim milk is usually about 32.5% of digestible protein, 49.9% of carbohydrates, and 1.9% fats. On the other hand, dried buttermilk runs about 29.3% of proteins, 41.0% carbohydrates, and 6.2% fats. In practice the writer has found that these dried milks may be used interchangeably, pound for pound, in adult, or even chick, rations.

10. *Cod-liver oil* is come, along with sardine oil, to be looked upon as a chief source of the anti-rickets, or Vitamin D, factor for fowls confined in houses, and away from full exposure to the direct rays of the sun. Some commercial oils are so-called fortified, either as to their Vitamin D or even their Vitamin A contents. Other oils are straight run. Poultrymen must determine when buying these products what their approximate vitamin-potencies have been demonstrated to be.

4. *It must accomplish the above objectives in an economical fashion.*—One eye must be upon the quality and nutritive character of food stuffs under contemplation and the other eye upon the costs thereof. One reason why many efficient feed mixtures may not profitably be used lies in the fact that they contain ingredients which are too high in price, rendering the mixture uneconomical for practical use on the plant.

5. *It must permit of practical management.*—The egg farmer's time is worth money, and he must have a feeding program which can be conveniently and economically put across on the average plant. The feed bill is generally the chief item against the costs of table egg production. The cost of ingredients and mixing of rations is usually relatively high, and there must not be added to such initial costs any more items for cost of management than are absolutely necessary.

II. **A Typical Well-Balanced Series of Poultry Rations for Laying and Breeding Stock.**—The following rations are the revised formulas advocated by the Department of Poultry Husbandry at the New Jersey Agricultural Experiment Station, of which department the writer has been head since 1921. They have been proved to be efficient in accomplishing the objectives for which they have been made, and at the same time, under average feed prices, have proved to be comparatively economical, and their use profitable, other things being equal. They are not offered by the author as the only rations which will give satisfactory results, but rather are they presented as typical rations and formulas which will, properly fed, produce good results.

Fig. 61.—The chief objective of layer management must be to continuously stimulate regular and sufficient food consumption.

In addition to the selection of food stuffs as to their content of digestible nutrients, and their variety of food elements, it is always of paramount importance that, within each food stuff, there must be insistence upon uniform high quality. Poultry will show the ill effects of the use of poor quality food stuffs more quickly than will other farm live stock. Poultry, especially layers, must not be endangered by the use of food stuffs of questionable quality. There is no exception to this rule.

There are three fundamental forms in which adult poultry rations are usually prepared:

1. The long-practiced form of using (a) a grain mixture, primarily for maintenance purposes, and (b) a mash mixture, primarily for the stimulation of egg production. This form has been advocated by the New Jersey and many other agricultural stations and by thousands of practical egg farmers for many years. The way and manner of feeding these various forms of rations is as important as the formulas themselves, and so, as each formula is given, the simple management rules for its use will accompany.

a. *The New Jersey Laying Mash.*—To be supplied in open hoppers and to be kept before the layers and breeding flocks at all times—and to be fed after the pullets are about six months old, thenceforward.

300 pounds ground yellow corn (yellow corn-meal),
100 pounds wheat bran,
100 pounds flour wheat middlings,
100 pounds ground heavy oats (not less than 38 pounds to the bushel),
150 pounds soybean oil meal,
75 pounds meat scrap (55% protein grade)—one-half of this protein concentrate of animal origin may be constituted of a good grade of fish meal, if preferred, and if there is a price differential in favor of such substitution,

65	pounds alfalfa leaf meal,
25	pounds of dried skim milk, or dried buttermilk, or dried whey,
20	pounds of limestone flour or oyster shell meal, with manganese,
15	pounds steamed bonemeal,
10	pounds of salt—not needed if fish meal is used,
5	pounds of poultry feeding oil, (2000A-400D).

The amount of oil should be doubled, if the fowls do not have access to direct sunshine.

b. *The New Jersey Grain Mixture.*—To be fed to the laying flocks once daily in the late afternoon and throughout the entire year.

40	pounds of whole yellow corn, or coarse cracked, if preferred,
40	pounds whole wheat,
20	pounds whole oats.

This 20 pounds of heavy whole oats preferably should be clipped. During the pullet or first laying year there should be a grain consumption of approximately 10 to 12 pounds of this grain mixture per day per hundred layers, and an equal consumption, by weight, of the laying mash. The method of feeding the grain must be developed by common sense and observation of the apparent needs of the birds. It may be in some cases that a morning, and even a noon feeding of a portion of the day's grain allowance will be advisable. The flesh condition of the layers must determine this point, as well as the total amount of grain to be fed as each season progresses. In cold weather, it is natural that more

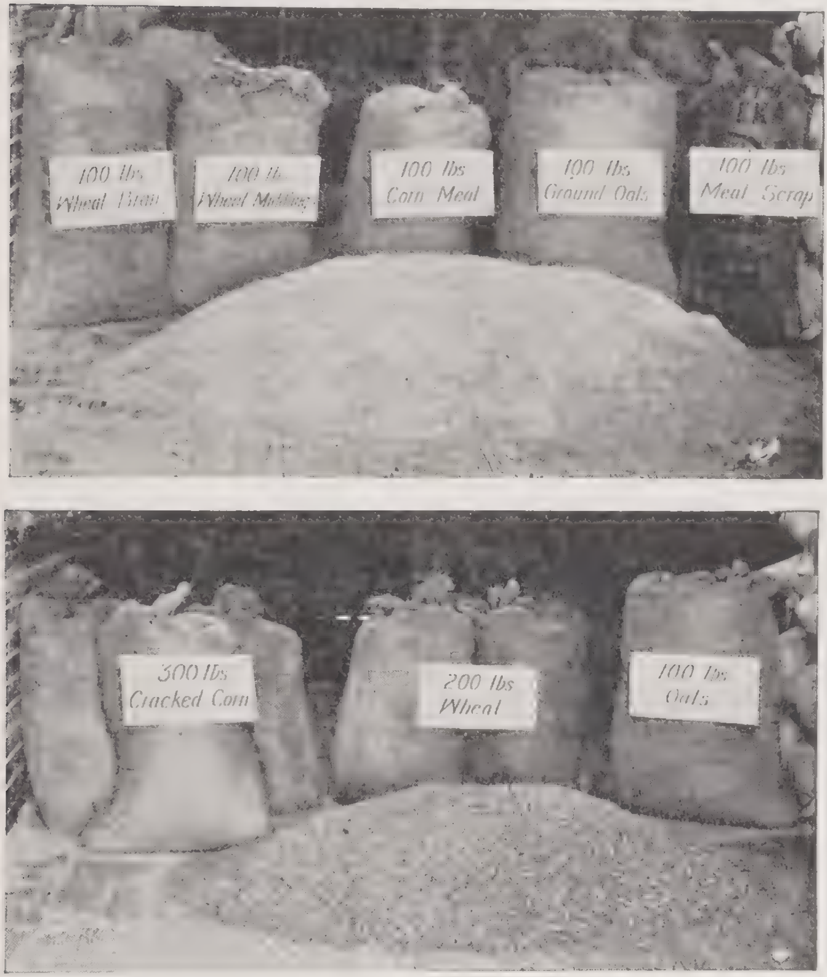


Fig. 62.—A well-chosen and economically managed feeding program is half the battle in modern egg production.

grain will be needed by the fowls for heat and energy production than is required during hot summer months. If the layers show signs of losing flesh, increase the grain fed, and if they tend to grow over-fat, cut down on the grain allowance. Grain rations may satisfactorily be fed either in

1. deep litter, being scattered in such manner as to make the hens work and exercise in the process of getting their grain ration—a method in wide use, but not favored by the writer because of its unsanitary features—, or

2. troughs, which invite immediate consumption, and are sanitary in operation.

c. *The Fleshing Mash.*—Poultrymen who have habitually come to use the dry mash and grain system of poultry feeding for egg production have found that, from time to time, in the course of forcing for heavy egg yields the tax upon the strength and vitality of the layers may show itself in their losing flesh, becoming thin, somewhat emaciated, and in apparent need of supplementary feeding. Whenever, therefore, the flesh condition of heavy producing egg layers begins to diminish and they begin to show loss of body weight, it is advisable to start feeding what is usually called a "fleshing mash." This consists of a moist mash, fed in such manner as to stimulate further and greater food consumption and an added intake of the type of foods which will restore body flesh and a reserve of body fat to enable the birds to carry on through the balance of the production year. This fleshing mash is variously made up. The writer likes to use either of the following forms:

1. A mash mixture made of equal parts by weight of (a) yellow corn ground, (b) ground heavy-grade

oats, and (c) condensed milk product (one-half part of one of the powdered milk products). Make some of this mixture up to a crumbly moist mash, preferably with liquid skim milk (soured, preferably), or water. Feed once daily, around the noon hour, at the rate of 3 lbs. for each 100 layers. Scatter this moist mash along on top of the regular dry mash in the open troughs or hoppers. The fowls will eat it with relish and probably consume considerably more dry mash also as a result.

2. Make up a moist mash by using some of the regular laying mash and liquid sour milk or water, and using at the same rate and feeding in the same way as above suggested for the special "fleshing" mixture.

Use the "fleshing mash," as a daily supplement to the regular laying rations on pullet flocks in full lay, that is, probably, during the winter and spring seasons, usually stopping its use as May recedes and the percentage yield drops somewhat.

d. *The Supplementals to Laying Rations.*—It is always desirable to keep the poultry feeding schedules down to as simple terms as may be consistent with proper nutrition. But, in addition to the above three fundamental parts of the usual layer-feeding program, it is necessary to give some supplementals, as follows:

1. Green, or succulent, foods, primarily for the purpose of aiding in keeping the physiological processes of the layers in smooth, operating order, so that medications or laxatives should be unnecessary. The

use of some sort of green, or juicy supplementary food, is especially desirable during the three or four winter months, following the growing period, particularly if that has been spent out on range or in fields where green crops have been a daily part of the pullets' rations. Sprouted oats, or other sprouted grains, or germinated oats; cabbages; or mangel beets may be used. Feed sparingly. The use of such green, or succulent, foods after the winter months is probably not essential.

2. Keep coarse granite grit, and coarse oyster shell, before the layers in side wall hoppers where they may have access to it when they wish.

e. *Rations for Poultry Breeding Stock.*—The average ration, of the mash and grain type, recommended for breeders will vary from that used for layers, that is pullet table egg producers, usually and primarily in that it should contain somewhat more of yellow corn, fish meal, and alfalfa meal—at least, so feels this writer and so do many New Jersey and other poultry feeders of good breeding stock agree. The New Jersey Station formula for *the breeding stock dry mash* follows—fed in same manner as laying mash:

300 pounds ground yellow corn (yellow cornmeal),
100 pounds flour middlings,
100 pounds wheat bran,
100 pounds ground heavy oats,
150 pounds soybean oil meal,
{75 pounds meat scraps (55% protein), or
{75 pounds fish meal,

25 pounds dried buttermilk, dried skim milk—the writer would supply one-half of this milk in the form of whey powder, if price permitted, and certainly if there was a favorable price preferential in its favor.
65 pounds alfalfa leaf meal,
15 pounds steamed bonemeal,
5 pounds of poultry feeding oil, (2000A-400D).
10 pounds iodized salt.

Fig. 63.—Well selected poultry breeding stock, Barred Plymouth Rocks, must be properly fed, if good hatches of strong, sturdy chicks are to be secured.

This mash will produce darker egg yolks than do many usual laying mashes. It may be used for laying flocks in sections where no price distinction against the darker yolks prevails. This ration tends to produce better hatchable eggs and better quality chicks with more leg color. The lower protein content of this mash is designed to slow up the egg yield somewhat and conserve strength and thereby produce better quality hatching eggs.

The *grain ration for breeding stock* is the same as for layers, as is also the supplementals and the fleshing mash part of the feeding part of the program. The protein-containing fleshing mash formula mentioned first above may be found very useful for breeders during the hatching season.

2. The second general form of feeding practice for either laying or breeding flocks which should be mentioned in this place is the *"all-mash"* ration. There is little that is radically different in this idea from the mash-and-grain type of ration. The "all-mash" ration is simply, in principle at least, the putting of all the essential ingredients into one mixture and grinding that up together to furnish just one feed mixture for use of the fowls. It is, as its name implies, truly an all-mash mixture. The idea is that this one mixture, in the form of a dry mash, may be kept before the fowls at all times and that it alone will constitute the entire feeding schedule for those fowls. It has been tried widely for chicks, for growing fowls on range, for laying in the table egg production pens, and for breeding stock. Various poultrymen have expressed varying degrees of satisfaction with its use. The writer feels that in the hands of the novice it has distinct advantages, but that the experienced and intelligent poultry

feeder may secure better results from the use of the former type of ration, in which his discretion as to balance between portions of the program may be exercised. The New Jersey Station Poultry Department has not advocated the use of an all-mash system for feeding of adult stock, but when such has been demanded it has suggested that the following all-mash mixture may quite safely and economically be used for both chicks, growing pullets, and adult stock:

50 pounds ground yellow corn,
10 pounds wheat bran,
10 pounds flour middlings,
10 pounds pinhead oats—or ground heavy oats,
10 pounds meat scrap (55% protein),
5 pounds dried skim milk, or dried buttermilk,
3 pounds oyster shell meal, or limestone flour,
1 pound cod-liver oil (mixed with pinhead oats),
1 pound table salt, preferably iodized.

When used for pullets, especially those not reared on range, or where green food is not available during the growing season, this all-mash formula may be improved by the addition of 5 pounds of alfalfa leaf meal, and possibly 5 pounds of bone meal.

When employing the "all-mash" scheme care must be taken to keep a supply of fresh mash before the fowls, of any age, at all times, and it must be so managed as to stimulate sufficient consumption at all times to accomplish approximately the same results as would be expected from the usual mash and grain type of feeding.

3. The third form of ration to be mentioned here is a comparatively new proposition in American poultry feeding, namely the pellet form. The pellet ration is simply a mash mixture which has been put through a pellet-making device and formed into small pea-like pellets. The basic principle is interesting, and this writer believes, sound. It consists of mixing together the ingredients which science, experimentation, and experience have found best suited to the complete nutrition of the given class of fowls being fed into just one mixture and then putting that mixture into such form as to make it impossible for fowls to pick and choose as to the food particles which it will eat. The fowls, fed on pellets, must take the balanced ration whenever they eat anything at all. This tends to counter-act the wide variations existent among average fowls as to their food consumption behaviors. Some fowls are persistently mash eaters and poor grain consumers, and others are just the reverse in type. Pellets, in principle, give fowls little chance for choice. This form of poultry feeding has been taken up by several commercial feed manufacturers recently and is creating some attention in the commercial egg farming industry.

III. The Use of Artificial Lights Has a Stimulating Effect.—Much argument has been expended in recent years over the use of the artificial lighting of poultry houses, especially in connection with table egg production flocks. The writer has been a close observer of this practice in New Jersey and in many other sections, including England, over a period of twenty years, and he has come to the following conclusions on this important point in layer management:

1. *Lighting Has Definite Objectives.*—Experience seems to have demonstrated that the following objectives are at the back of the use of artificial illumination of poultry laying houses:

a. To furnish a more uniform, even set of environmental conditions for layers, and thereby to insure a more uniform and even rate and amount of food consumption during those months of the year when natural climatic or weather conditions are widely variant, and when increased food consumption is especially necessary and greater egg yield is economically very significant. By use of a conservative management of artificial illumination layers may be given winter days of approximately equal duration, and days made sufficiently longer than the naturally lighted days of that season to react to a very considerable increase in activity and food consumption.

b. To stimulate a more active use of egg-producing food stuffs, and therefore to bring about an increased rate and amount of egg yield.

c. To render laying flocks, always sensitive to their surroundings, less liable to the detrimental effects of suddenly changing outside weather, especially temperature, conditions.

d. To effect, directly or indirectly, beneficially the general health of the fowls, and through the provision of elements of a more uniform, or less fluctuating, environment to preserve that health.

2. *Should Artificial Illumination Be Used for Pullet Flocks?*—For the average egg farmer, definitely "Yes." The suggested scheme is:

a. After the pullet flocks have been brought in from range, or after they have just about reached egg-laying maturity, they may go under lights. This usually means that along in late September, or during October, and certainly by November 1st, pullet layers will be ready to place under the controlled, and more uniform management of "managed days." This means being placed under days of equal length. It is well to get these new layers accustomed to the lengthened and the uniform-length day some days before they advance into egg yield to any great extent, but pullets should not be placed under lights before they have reached full body maturity and have put on that reserve of body flesh and fat which has been spoken of as being essential to holding up under forcing management for heavy egg production throughout the first laying season.

b. Continue pullets, once placed under lights, under the same continuing system, avoiding changing the lengths of lighted days during the winter season. The writer prefers to use an uniform day of 13 lighted hours throughout the winter season, and to start this about October 15th, other things being equal.

c. In the spring when natural daylight has come to such extent as to naturally provide at least a 13-hour lighted day, the use of artificial lights may be suspended. Take about ten days in which to wean layers from the habits formed by use of the artificial lights.

3. *Several Schemes of Managing Artificial Lights Feasible.*—The average experience of egg farmers, in the observation of the writer, has demonstrated no particular advantage for any one of the following schemes of lighting management over the others. It is suggested, then, local conditions and personal preference and any possible cost differential must determine for each egg farmer which method to employ:

a. The "morning lights" method. This means the turning on of the artificial lights at such hour of the morning as will insure a 13-hour lighted day before the close of the day, that is when the fowls naturally seek the roosts as twilight falls. No lighting is used at the closing end of the day. Alarm clocks, or regular time-clock devices, are used for the turning on the lights, in case electricity is used, and the same devices may be used for turning off of the lights, or they may be turned off by hand at or near breakfast time. The fowls may be sent to the perches with full crops at the natural end of the lighted day, after which they will use and digest the food and be hungry and ready for more food in the early morning hours when the artificial lights are turned on. If this scheme is used, some provision must be made to have both food and water available for the fowls as soon as they are brought down from the perches with the coming on of the lights.

b. The "morning and evening" lighting scheme. By this plan the artificial lights are turned on at a stated time each day, by hand or otherwise, and then used toward the close of the day, for such extent as to accomplish the same lighted effect as might be done by use of morning lights alone. The writer suggests turning on the lights each morning at 5 A.M., off at daylight, on in the afternoon as dusk comes on, and off at 6 P.M., thus having created a 13-hour day.

c. The "evening lunch" scheme is a third variation. This comprises using lights for approximately an hour sometime during the late evening hours, when the fowls are brought down from their perches, fed again, and then allowed to go back to roost. This usually means the use of an hour somewhere between nine and eleven o'clock during the evening. This scheme should be accompanied by the heavy grain feeding early in the afternoon, rather than at dusk, in order that the fowls may be hungry when brought from the roost at the beginning of the evening lunch period.

The writer usually prefers the "morning and evening" scheme.

4. *How Much Light Is Needed?*—The amount of electric lighting which may well be used as a model or unit is approximately that, originally worked out and offered by Cornell University, and varied quite slightly by practicing poultrymen from time to time

and in different sections. Briefly, optimum lighting may be accomplished by

a. One electric unit for each 200 sq. ft. of floor space, or major fraction thereof. For the New Jersey Multiple-Unit Laying House 20′ x 24′ section, with its 480 sq. ft. of floor space, therefore two electric units will satisfy the requirements for optimum lighting.

An electric lighting unit, as here used, consists of one 40-Watt, Mazda, unfrosted globe, or equivalent, furnished with a reflector–4″ deep at center, and 16″ in diameter at widest dimension.

b. Place the electric lights 6′ from the floor, and mid-way between the front wall and the line in front of the perches, and mid-way as to the width of the pen, thus dividing the area about equally and securing optimum lighting of the floor, or working, area.

IV. **Poultry Feed Prices Must Be Constantly Watched.**—While the egg farmer must never sacrifice essential nutrient elements or quality of poultry food stuffs to price advantages, he must, whenever possible, use those foods and mixtures, that is rations, which can be purchased or secured for use in poultry feeding at economical rates. The cost per hundred weight for either single ingredients or for finished mixtures must always be determined and closely computed. If savings may be affected by shopping about for food stuffs, well and good, but with every necessary emphasis possible upon keeping the cost of poultry rations down to a minimum, consistent

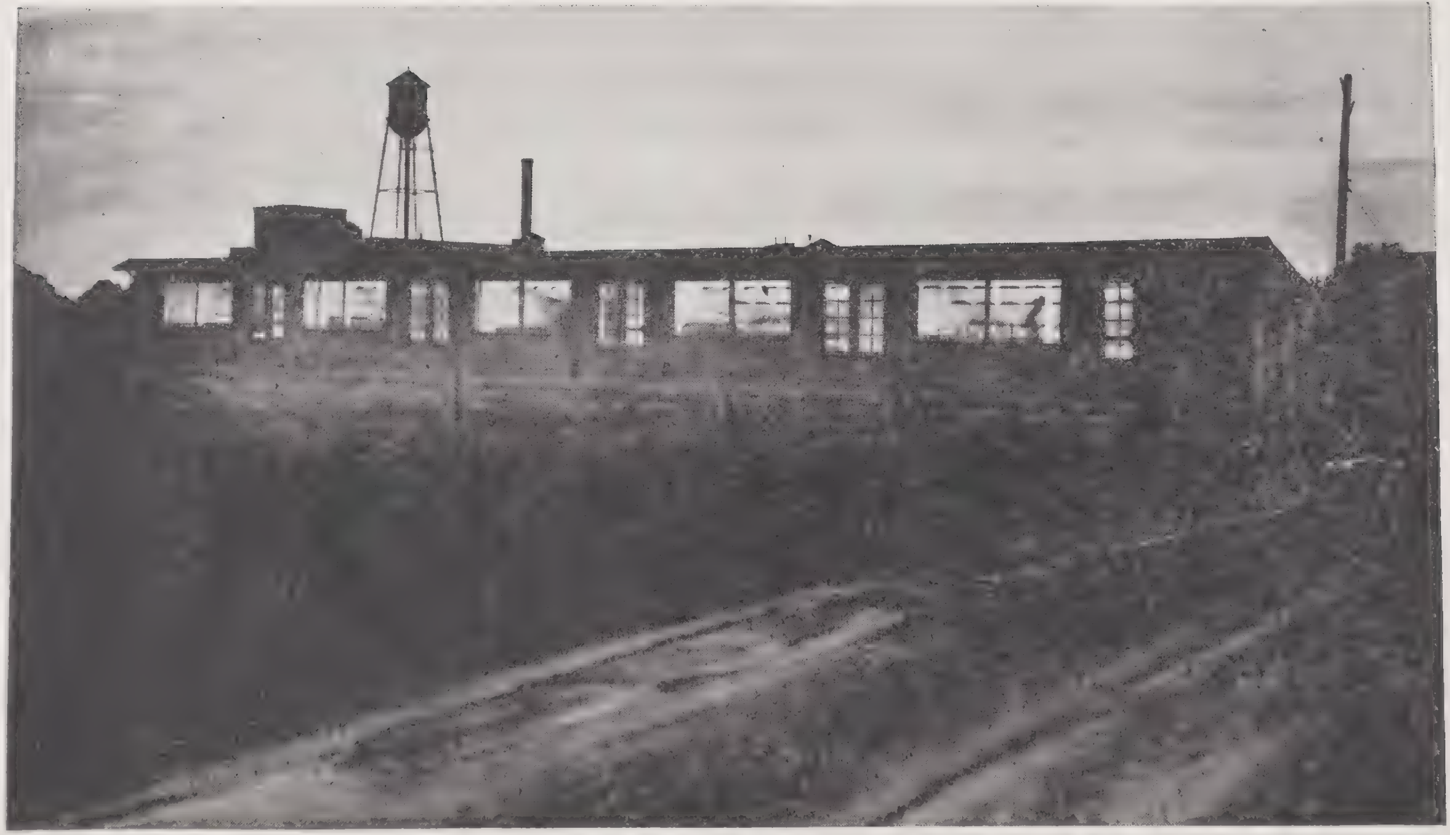


Fig. 61.—A Multiple-Unit Poultry Laying House, equipped with electric lights—shown in use with evening lunch lights turned on.

with efficient results and profits, there are certain items in connection with food securing that must be borne in mind:

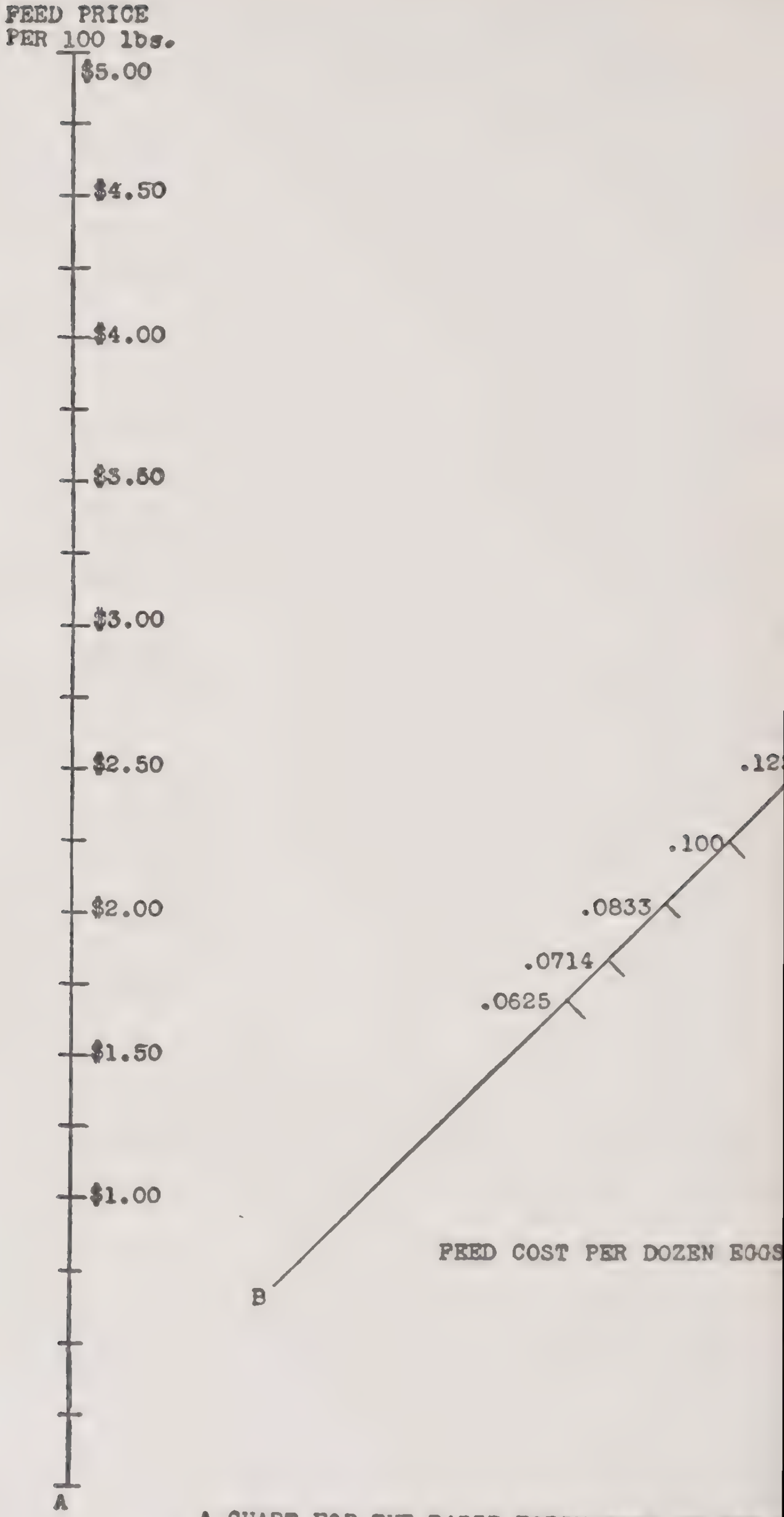
1. Fowls are creatures of habit and do best under quite regular, uniform, even conditions of environment, including feeding. Find a satisfactory ration and method of feeding, be it home-mixed or commercial brand, and then stick to it as long as it continues to render satisfactory results. Frequent changing of rations on layers and breeders is often responsible for many poor results reported on egg and poultry farms.

2. Insist upon an uniform high quality of all ingredients used in home-mixing of poultry rations, and in all commercial mixes used. Moldy, musty, spoiled food stuffs of any kind are taboo in modern poultry feeding.

The business-like egg farmer should constantly appreciate that his chances of profit lie chiefly in (a) maintaining health and active egg production, that is high egg yields, in his laying flocks, and in (b) keeping feed costs to a minimum. These are fluctuating factors both of which have a great influence upon profits. It is urgently necessary that the egg farmer compute the "feed cost per dozen of eggs" frequently during a season when (a) feed prices are changing more or less rapidly, (b) when egg yields, in terms of percentage yields, are fluctuating, and (c) when egg sales prices are moving with fluctuating market conditions, in order that he may know whether he is producing eggs at a loss, just at cost, or at a profit. Too often the check-up is made too infrequently to act as a real aid to future management improvement, either as to production or as to marketing.

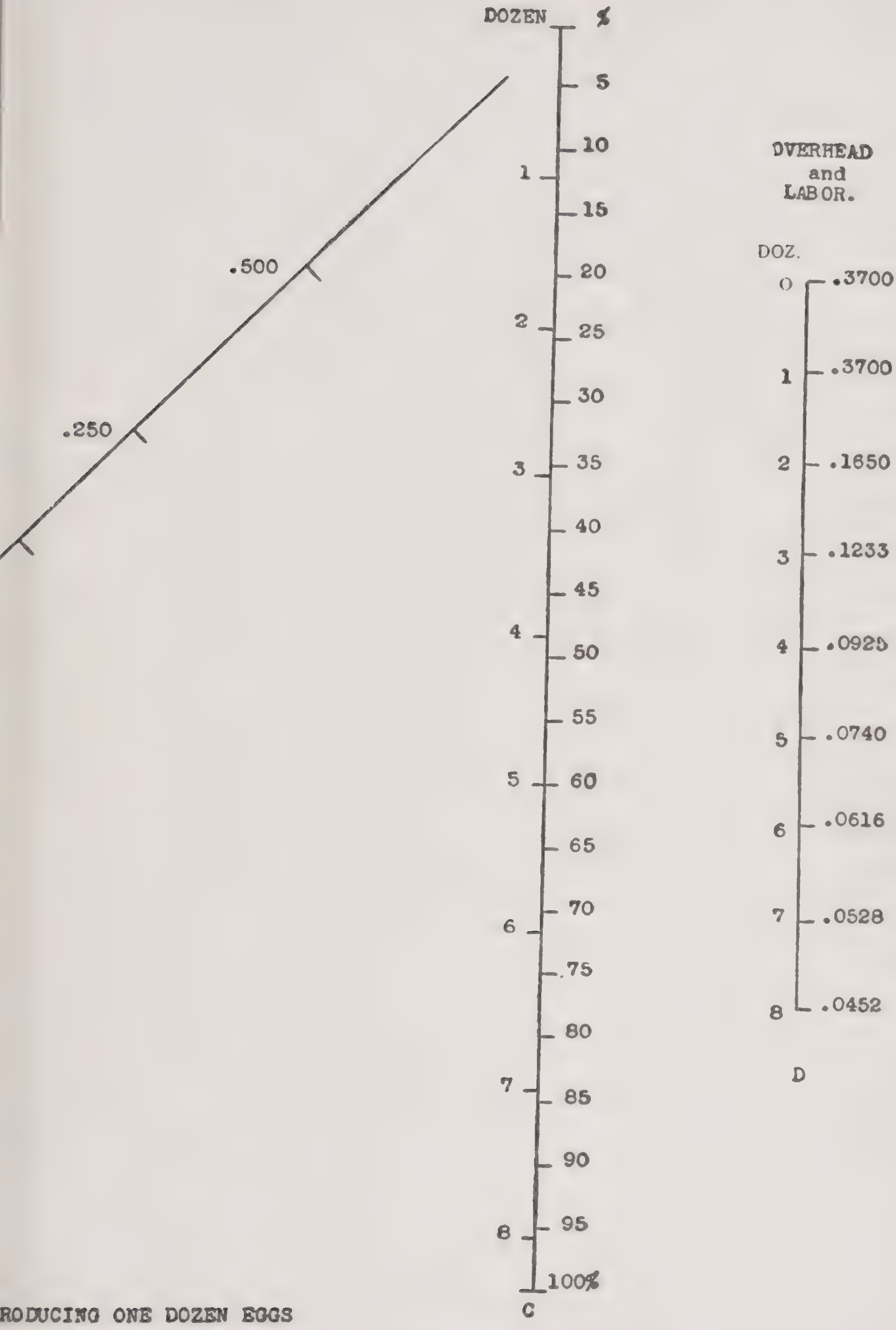
Four primary factors entering into the determination of the costs of egg production. (1) The feed price per 100 pounds, and the rate of consumption of feed per day per 100 layers; and upon the average consumption of 20 pounds per day per 100 layers. (2) The percentage of egg yield. (3) Labor cost. (4) Over-head cost, including all other items. Both labor and over-head figured together under average conditions will cost approximately 37 cents per day per 100 fowls.

The Use of Home-Grown Poultry Feeds.—In some sections of the country where egg farming is being practiced on a commercial basis the use of acres of farm land for the growing of field crops may be economical and profitable. The marketing of certain of those crops through feeding them to efficient poultry layers and breeders may be well worth consideration. From a consideration of the foregoing pages of this chapter, it will be seen that the possible farm-grown crops fit into a sound poultry feeding program: corn, oats, wheat, alfalfa, clover, buckwheat, soy beans, cabbages, mangel beets, and many others. If economic conditions on a given farm are such that the needed food stuffs for poultry feeding may be secured more economically by home-growing of them on the farm acres, it should be done, but if economic conditions are not such as to provide those feeds economically by home-growing



A CHART FOR THE RAPID ESTIMATION OF THE

Fig. 65.—The cost of egg producti



nation alignment chart. *(Courtesy of N. J. Station.)*

the purchasing of food stuffs is the only alternative. There is a very legitimate industry in this country which is concerned with the providing of egg farmers with high quality, balanced rations for poultry layer and breeder feeding. It may serve the egg production industry economically and efficiently, for the feed problem is one of the most important which the table egg producer has to face.

VIII

THE HANDLING, GRADING, PACKAGING, AND DISTRIBUTION OF TABLE EGGS

The modern egg farmer must, first of all, become a master producer of the sort of product which the buying public wants and is willing to pay reasonable prices for. He must know how to produce high quality eggs, and how to do it so that there may be a reasonable margin of profit between what such production has actually cost and what his customers have been willing to pay for those eggs. The foregoing chapters of this book have discussed problems of production primarily, and they have presented the modern egg farmer as a manufacturer or producer, and that he really is. But quality production and efficiency and economy of production will avail little unless the product sells for prices which will establish profit in the enterprise. The securing of a reasonable sales demand for eggs and the turning over of eggs produced to buyers thereof becomes the second great and important function which the modern egg farmer must master. He must, at once, be a good merchandizer, a good salesman, and a successful marketer of the products of his egg farming enterprise.

The egg farmer must (a) understand table eggs and all that the consuming public demands in the line of table eggs, (b) ways and means of grading and arranging table eggs to meet public demands, (c) packaging of table eggs that is safe and economical and efficient as a means of transferring those eggs from place of production to or toward places of consumption, and (d) he must know how to use the routes of trade between farm and consumer. In short, the egg farmer must turn much attention to markets and marketing methods.

In this book space only is available in which to outline a workable, practical, and economical method of caring for table eggs produced on the egg farm. It is the attempt merely to suggest a way of dealing with the marketing of the eggs produced on the modern egg production plant which is typical of the better schemes now to be seen in operation in the larger table egg producing areas.

The title of this chapter suggests the four main problems which the egg farmer has to solve after some fashion or other in order that he may realize income and possibly profits from his enterprise. The degree to which he does solve these fundamental egg-marketing problems on any given poultry plant will determine to a marked extent the degree of profit which he may earn.

I. **The Handling of Table Eggs on the Farm.**—Consumers demand a quality product, especially in the matter of table eggs, and that tendency has been growing steadily during recent years. In sections where true egg farming, as a business, has been developing there is to be found in close association with it a changing trend in market demands with regard to table or breakfast eggs. This trend is proved by the passing of fresh-egg laws in several of the states, as in New Jersey (The Prall Fresh Egg Law of 1934), laws which emphasize the public's interest in being protected in the purchase of eggs in order that quality may be secured when quality is paid for.

Much of the quality which a table egg possesses is the result of the feeding program used on the flocks which produce the eggs. The rations and methods of feeding which are similar to those actual formulas given in Chapter VII tend, other things being equal, to produce high quality eggs, both in flavor, consistency, and nutrient and vitamin content. The first step, then, in the insurance of high quality table eggs on any given egg farm or from any particular egg-producing flock of fowls lies in the furnishing of complete, balanced rations, rich in nutrients and vitamins, to the birds producing those eggs.

However, taken for granted that a carefully chosen feeding program has been adopted and is followed regularly, there are other items in farm management, items of daily routine, which have a direct bearing upon the maintenance of high quality in eggs gathered:

1. Nests should be kept scrupulously clean and well littered, as has been heretofore described, in

order that eggs may not become soiled or broken.

2. Eggs should be gathered twice daily, at noon and in late afternoon, again to prevent soiling and breaking, and to avoid chilling in cold weather and over-heating in hot weather.

3. Use wire egg baskets in gathering eggs, as this aids in cooling the eggs as quickly as possible, an important point in an effort to maintain high quality.

4. With a damp cloth, perfectly clean and moistened only with clean water, or with a fine sand paper tacked over the soft pad of an ordinary lamb's wool shoe polisher, clean whatever eggs are soiled when gathered. Aim to produce clean eggs and keep them that way without having to wash or sand them, if possible.

5. Store eggs in a cool, and not too dry, room—with a temperature about 50° F., as near uniform as possible. Avoid keeping table eggs in a warm room, or a dusty, dirty room, or in a room filled with strong odors.

6. Candle, grade, and package the eggs as soon as possible after they have been allowed to stand in the wire baskets for a few hours to get thoroughly cooled.

7. Market table eggs every few days, in order to preserve those qualities which mark them as fresh eggs.

II. The Egg Room Is an Essential on the Modern Egg Farm.—On a plant of several hundred layers or more the setting aside of a room, or

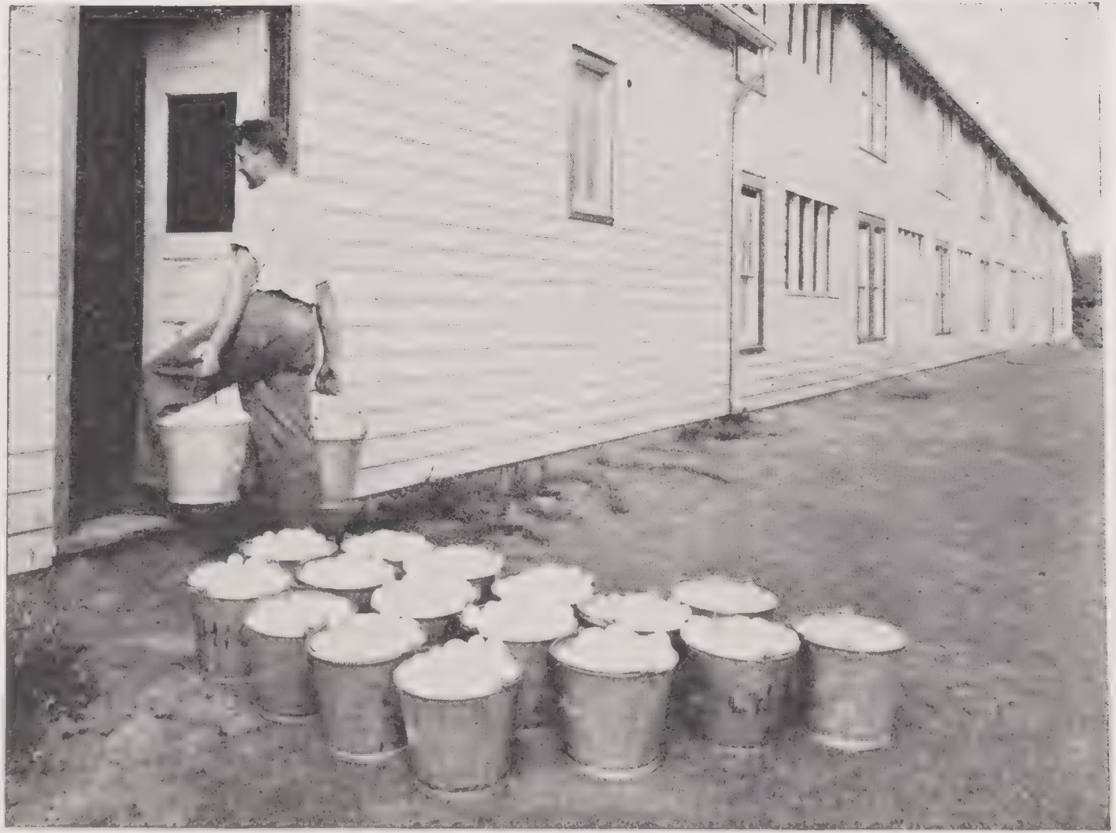


Fig. 66.—A proper method of gathering strictly fresh table eggs on a large commercial egg farm in New Jersey. *(Courtesy of Strohlein Bros., Montville, N. J.)*

the building of a special room for the handling of the table eggs is absolutely essential to continuing in being able to furnish strictly fresh quality of table or breakfast eggs. The egg room is a simple device, but should be properly set up and equipped and carefully managed in order to produce the desired results.

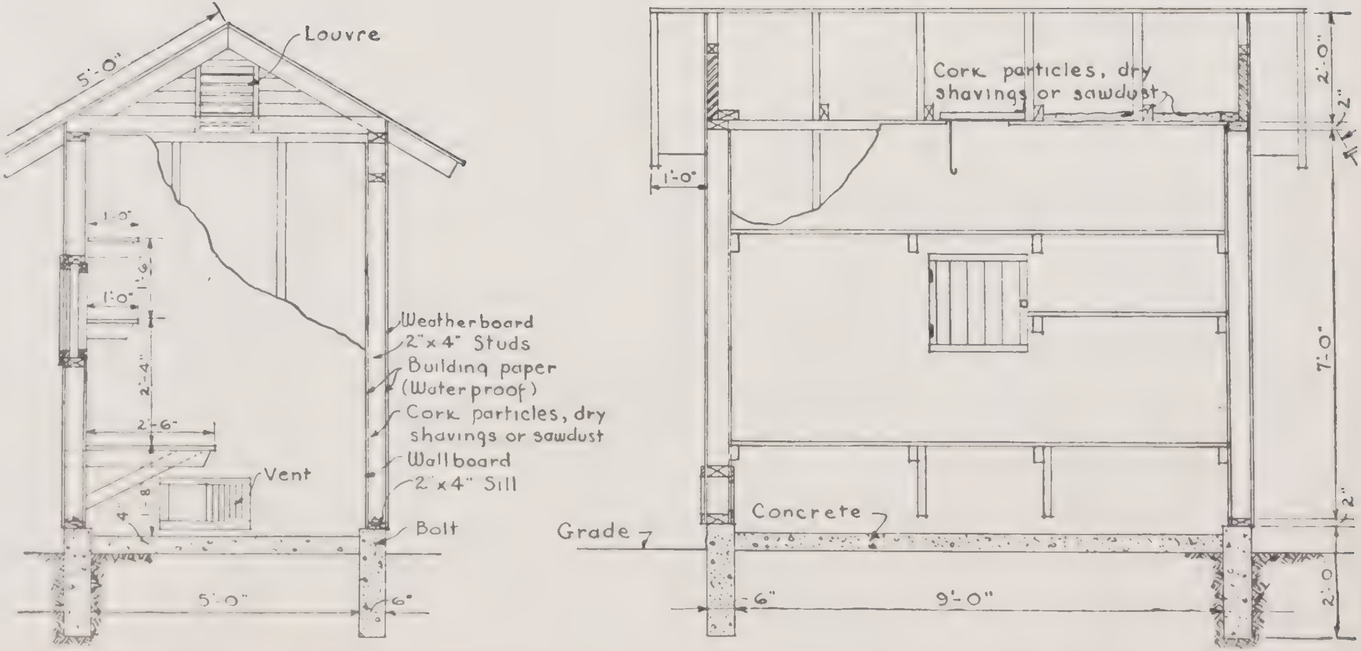
1. Preferably insulated, so as to maintain an uniform and even temperature condition. The New Jersey Station has issued plans, as have several of the other agricultural research institutions and agricultural colleges, for "an insulated egg room."

On practicaly every egg farm there is some small room available which may be insulated quite readily and inexpensively by use of reliable commercial insulating boards or materials.

2. Well ventilated, in order to keep the air cool and free from stale, musty, or bad odors, and to aid in keeping the eggs in normal, fresh condition.

3. Clean, that is free from dust, dirt, and filth, and vermin. The egg room is not a place for storage of things. Limit the equipment to the bare essentials required in the handling of the eggs and to a small surplus of egg cartons, fillers, cases, and implements needed in the packaging of the eggs. The larger surpluses of cartons and cases should be stored somewhere outside of the egg room. Make sure that the egg room is made mouse- and rat-proof.

4. Fitted with a bench, or table on which the eggs may be handled with ease and a minimum of shifting or handling. Arrange the equipment so as



SECTION "B-B"

SECTION "A-A"

Fig. 67.—The plans for the New Jersey insulated egg room illustrate the principles which should be incorporated in any egg room on any egg production plant.

to increase convenience and save labor and hasten the handling process.

The minimum equipment for the egg room on the average size egg production plant might be listed as:

a. An electric candler, so placed as to make the candling of all eggs packed easy and efficiently accomplished.

b. An individual egg scale, on which trial or sample eggs may be weighed from time to time as a check-up on the size of weight pack being handled.

c. Wire egg baskets, or metal pails.

d. Cartons, cases, fillers, flats, etc.

In larger egg packing rooms labor-saving machines, such as the automatic egg weighing and grading machines, or even sanding machines, are a necessity.

III. **The Grading of All Table Eggs Sold Is Demanded.**—In these days of fresh egg laws and increased prices paid for quality table eggs it is an invariable rule that all table eggs sold from the plant should be carefully and systematically graded, and packaged accordingly. There are two principal parts to this home-grading process:

1. *Candling* is the process of holding an egg up before a bright light, so arranged that the major part of that light has to come to the observer's eye through the egg, thus showing up something of the interior condition of that egg. Every table egg sold from an up-to-date plant should have been candled

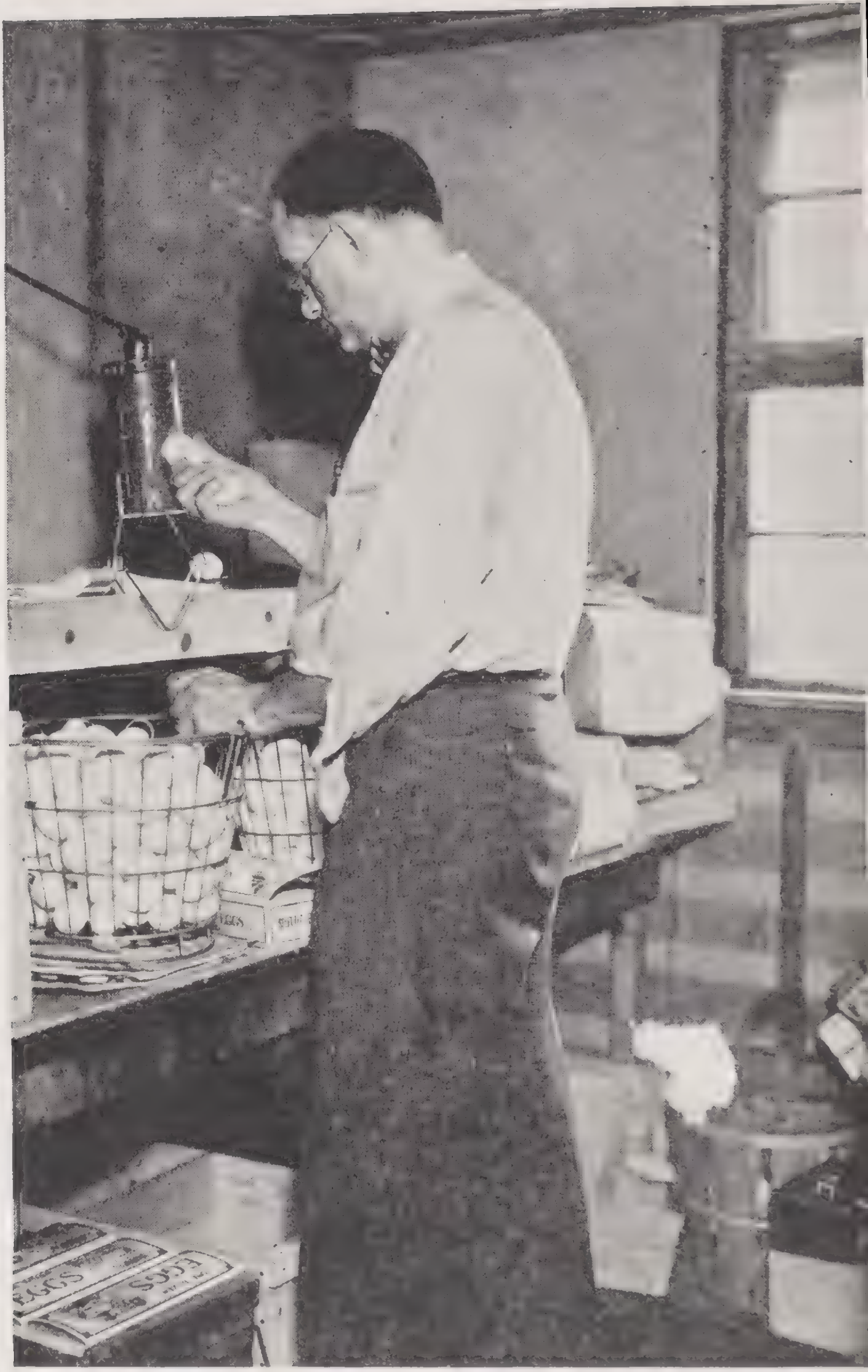


FIG. 68.—A corner of the egg room on the N. J. Exp. Station Poultry Plant, showing the various pieces of essential equipment used.

automatically before it ever left the plant. Candling reveals several important things about an egg:

a. Presence of blood-clots, known as blood spots, within the egg shell, showing as dark, opaque areas before the candle. Never include blood spots in eggs to be merchandized.

b. Size of air-cell at large end of the egg. In strictly fresh eggs the air-cell should not be much larger than the size of a dime, and not more than one-sixteenth inch deep. The air-cell increases with age, which factor allows evaporation to take place through the shell, thus shrinking the contents.

c. Color of yolk, varying from scarcely visible yolks, showing as the merest shadows before the candle, to the dark yolks, showing as deep, reddish areas. The New York City market tends to demand a light colored egg yolk.

d. Consistency of white, or albumen, judged by mobility of yolk when the egg is twirled before the candle.

e. Condition of egg shell, its thickness, or thinness, and any blemishes, cracks, or defects which may be in it.

2. *Grading proper* includes the sorting of the eggs according to the requirements of the market class or grade which is being used as basis of egg sales. Each state is coming to have its own system of recognized State Egg Grades. They are quite similar. The objective in all state or individual market or federal government egg grade projects has been to attempt to standardize egg grades so that

consumers over wide areas might come to know and understand the minimum characteristics required of eggs sold under the various market terms, or grade names. Much is yet to be accomplished along this line, but, on the other hand, much has already been accomplished. The State Department of Agriculture in New Jersey has been permitted by state law to promulgate grades and grade names for fresh eggs produced in that state. The main features of the New Jersey State Egg Grades have been presented in Hints to Poultrymen, Volume 19, No. 7, April, 1931, under the authorship of Mr. Alben E. Jones, of the N. J. State Department of Agriculture, and Prof. C. S. Platt, of the N. J. Agr. Exp. Station staff, and direct quotation concerning those grades is as follows:

New Jersey Fancy Grade (large size).—Clean shelled eggs of uniform size and exceptional quality weighing not less than 24 ounces to the dozen (45 pounds net to the standard 30-dozen case) with a minimum weight of 1⅞ ounces (23 ounces to the dozen) for individual eggs. The interior quality of the New Jersey Fancy Grade shall conform to the established standards of the U. S. Department of Agriculture for "U. S. Specials" as follows: Air cell —⅛-inch or less in depth, localized, regular; yolk—may be dimly visible; white—firm and clear; germ —no visible development.

New Jersey Fancy Grade (medium size).—Clean shelled eggs of uniform size and identical interior quality with New Jersey Fancy Grade (large size) but weighing not less than 21 ounces net to the dozen (40 pounds net to the standard 30-dozen case) with a minimum weight of 1⅝ ounces (20 ounces to the dozen) for individual eggs.

Tolerance.—A tolerance of 10 per cent net will be allowed in each class, of which at least 8 per cent must be in the grade next lower and the balance covering all other defects, such as cracks, slightly dirty, tinted, and other lower grades.

New Jersey Grade "A" (large size).—Clean shelled eggs of uniform size and excellent quality weighing not less than 24 ounces to the dozen (45 pounds net to the standard 30-dozen case) with a minimum weight of 1⅞ ounces (23 ounces to the dozen) for individual eggs. The interior quality of Grade "A" shall conform to the established standards of the U. S. Department of Agriculture for "U. S. Extras" as follows: Air cell—⅜ inch or less in depth, localized, regular. Yolk—may be visible. White—firm and clear. Germ—no visible development.

New Jersey Grade "A" (medium size).—Clean shelled eggs of identical interior quality with Grade "A" (large size) but weighing not less than 21 ounces net to the dozen (40 pounds net to the standard 30-dozen case) with a minimum weight of 1⅝ ounces (20 ounces to the dozen) for individual eggs.

Tolerance.—A tolerance of 10 per cent net will be allowed in each class, of which at least 8 per cent must be in the grade next lower and the balance covering all other defects, such as cracks, slightly dirty, tinted, and other lower grades.

Storage Eggs.—All storage eggs must be sold in conformity with Section 9, "Rules and Regulations Governing Cold Storage and Refrigerating Warehouses and Places," (Reprint) Circular 124, Department of Health, Chapter 101, Laws of 1916, which reads as follows:

STORAGE GOODS PLACARDED FOR SALE

9. It shall be unlawful to sell, or offer or expose for sale, articles of food which have been held in any cold storage warehouse for a period of thirty days or over without notifying persons purchasing or intending to purchase the same, that they have been so kept by the display of a placard conspicuously marked "Cold Storage Goods" on the bulk mass or articles of food, and it shall be unlawful to represent or advertise as fresh articles of food which have been held in any cold storage warehouse for a period of thirty days or over.

Pullets and Peewees.—There is no provision for the selling of pullet and peewee eggs under state labels. Each producer, therefore, grades these according to his own standards. In actual practice, there should be a relatively small percentage of the yearly egg supply that will not meet the minimum requirements of the New Jersey Mediums; namely, 20 ounces to the dozen.

GRADING FOR THE WHOLESALE MARKET

Equipment.—Every producer should provide a suitable egg scale for the packing room and also an egg candler. The latter should be obtained, whether or not the producer wishes to sell candled eggs, in order to check from time to time the quality of eggs he is packing.

Containers.—Egg cases and other containers used in the sale of eggs should be clean, either new or second-hand. In using second-hand cases, care should be taken that all loose parts are renailed. Flats and fillers should be either new or perfectly clean. This precaution enhances the sale value of the eggs contained in the package.

Grading to Size.—With a little practice, the producer becomes adept in the selection of eggs to size and it is always good policy to be on the safe side by giving a little more in size than the requirement.

Large Size.—For both New Jersey Fancy Grade and Grade "A" (large size), the weight requirements are the same, 24 ounces average to the dozen with a minimum weight for individual eggs of 1⅞ ounces (23 ounces to the dozen). It should be remembered, however, that too many 23-ounce eggs will pull down the average weight. It is also unwise to try and balance this weight by the addition of 28 and 30-ounce eggs, as this makes the whole pack lack uniformity and in this way detracts from its value.

Medium Size.—For both New Jersey Fancy Grade and Grade "A" (medium size), the weight requirements are the same, 21 ounces average to the dozen with a minimum weight for individual eggs of 1⅝ ounces (20 ounces to the dozen). The same precautions must be taken in packing the medium size as are given for the large size, since too many 20-

ounce eggs will have the same effect on the medium pack as the 23-ounce egg in the large pack. An excess of this size should be placed in the Pullet Grade.

Tints.—With white shelled eggs not more than four or five tinted eggs should be included in either Fancy Grade or Grade "A," either size. An excess of tints should be placed together in a container and sold as such. In this way, the price received will be nearly equal to that of other eggs since the tinted eggs will then be rather uniform in color.

Quality.—The only difference in the quality requirements of new laid eggs is the difference of yolk color, since there is no shrinkage. This can only be determined by candling. In the Fancy Grade, the yolk may be only dimly visible whereas in the Grade "A," the yolk may be clearly visible.

These New Jersey egg grades for fresh table eggs are based upon the fundamental grades suggested by the U. S. Department of Agriculture several years ago. Many states have followed the lead of the federal officials in this matter, and so have several of the larger egg markets.

The individual egg farmer should familiarize himself with the egg grades which his immediate customers demand and the grades used on the markets which command egg prices in his territory, and learn to make those grades according to best standards available. It is suggested that the grades suggested by the State Department of Agriculture in New Jersey might form a very desirable basis for grading of eggs to be marketed at retail or at the door, as they are basically sound.

IV. **The Packaging of Table Eggs.**—The modern egg farmer must become a skillful merchandizer of his products. His packages must be attractive. and they must carry the eggs from farm to home, or consumer safely and in good order. Essentially there are only two main types of packages which the egg producer finds necessary in his business:

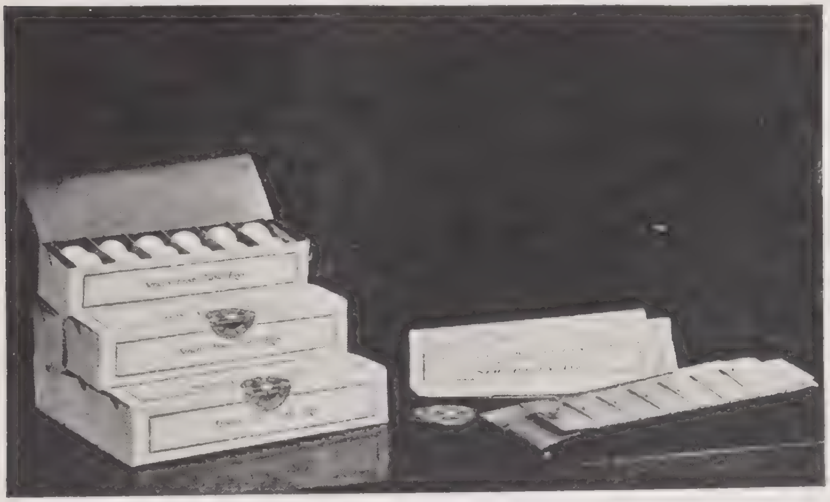


Fig. 69.—A neat, attractive carton is an important part of successful merchandizing of fresh eggs.

1. Individual one-dozen egg cartons. These cartons should be attractive in design, safe in protection of the eggs in transit or handling, and not too expensive in cost.

2. Ordinary thirty-dozen cases, for packing of large shipments. These should preferably be new

cases and clean, new fillers and flats. Cases must be carefully packed and neatly marked.

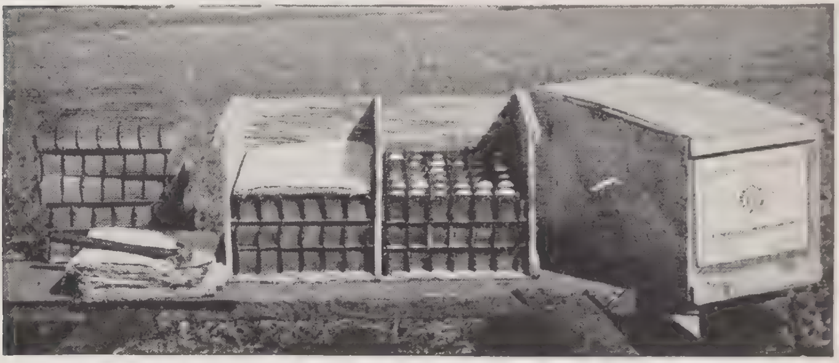


Fig. 70.—The 30-dozen egg crate has long been standard equipment.

V. **The Avenue of Marketing Table Eggs.**—The egg farmer must seek such outlets or customers for his table eggs as will bring in to him a sufficient sales price that will result in some reasonable margin of profit after all legitimate expenses of production have been met. In some cases the nature of the marketing or scheme of egg distribution will be of one type, and in other cases something very different, perhaps. The principal methods in use in table egg production centers today are—and they are simply enumerated in this place, for this has aimed to deal primarily with production and not with marketing, a subject worthy of lengthy discussion in itself—:

1. Retail selling of eggs. As the name implies, this method consists of selling table eggs direct to consumers. It is sometimes a matter of

a. Direct sale at the door, or at road-side stands, located on heavily traveled highways, or in strategic locations, or

b. Direct sale to regular customers on an established delivery route, or

c. Direct sale to local distributing agencies, such as delicatessen, grocery stores, etc.

2. Sale of eggs through auction markets, or cooperative egg selling organizations. These auction egg markets have been a pronounced success in various New Jersey areas in recent years, as well as in other states. Egg farmers should familiarize themselves with the location and personnel of existing agencies of this type in their community.

3. Sale of eggs at wholesale, by shipments to commission dealers in eggs and poultry products.

Egg farmers must search for that type of marketing scheme which will apparently bring in best net results under existing conditions. Having found some satisfactory avenue of distribution for his table eggs, he must build up a reputation for strict honesty as to grade and pack, and develop for his name a high standing as a business man who furnishes a high quality of product, uniformly and consistently.

Egg farmers are, in many respects, a group of producers greatly to be envied because of the assurance of permanency which is peculiarly the property of table egg production as an industry, because of its dealing in a food item which is an indispensable part of the daily diet of all our people, either in the form of breakfast eggs or table eggs as such or in the form of foods made in part through the liberal use of fresh eggs. This closing theme returns the reader to the original statement which opened these comments on modern egg farming. It is an honorable business, worthy of the attention of many people who seek a living through their labors.

FOOD [illegible] INSTITUTE

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